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VIEWS, NEWS AND INTERVIEWS

At Hartford, Ct., on the new transmission line which brings a large quantity of electric power into that city from a distant waterfall, the electric power company put up some aluminum wire feeders. A local newspaper, puffed up with pride and knowledge, said that this was exactly the right thing to do; it was in all respects a modern and up-to-date construction, and one of the advantages of aluminum wires was that they required no insulation.

Electricity is to be used in killing whales. A dynamo is to be placed on a whaling ship. A big reel of insulated wire will be carried in a boat when a whale is sighted. One end of the wire is connected with the dynamo, and at the other end will be a hard rubber stick attached to a piece of metal twenty-four inches long and one inch in diameter, sharpened at the end to penetrate the flesh of the whale. The rubber and metal rod will be used as a harpoon is now used. When near the big fish, the harpooner will throw the electric barb. When it strikes the whale, a current connection will be formed with the dynamo, the whale will get the full shock of 10,000 volts and will be dead in a fraction of a second. The Buffalo *Courier* deserves the credit for the above work of the imagination.

A fireman in Brooklyn, C. W. Travis, has been entered upon the roll of honor of the Fire Department for meritorious services attended with great personal risk in cutting electric wires which were lying in the street during the progress of a fire a few days ago. One person had already been killed by coming in contact with the wires, when the firemen cut them and removed them from the street. This is the first time that a fireman has ever received honors for such a service.

The Pinkerton Detective Agency, of New York, has just finished an investigation concerning the use of electricity by bank burglars. The Pinkertons apparently take very little stock in the reports of successful burglaries by means of powerful currents. In their report on the subject to the American Bankers' Association they say: "There has never been a successful burglary of a bank vault or safe by use of electricity, and we feel safe in assuring members that there is no necessity for alarm over what is claimed as the new power to commit burglaries. The use of electricity to melt steel has been known for many years, but it is impracticable to rob banks with it."

It is understood that three responsible companies and two syndicates intend to bid for the construction of the much-talked-of Rapid Transit Commissioners' underground railway in New York city. These parties are said to be the New York Central Railroad, the Third Avenue Railroad Company, the Metropolitan Street Railway Company, a local syndicate, and a British syndicate. There is a possibility that two or three of the contestants may combine their forces.

A decision in one of the most famous electrical cases that has come before a Connecticut court for adjudication, was rendered by Judge Wheeler, of the Superior Court, the other day, by which the plaintiff is awarded $2,000 damages against the Naugatuck Electric Light Company. Suit was brought to recover for injuries sustained by Mrs. Parks, of Naugatuck, last Winter, by taking hold of a bush in her yard, which had been charged with "loose electricity" from the company's wires. The case occupied several days of trial.

SKETCH MAP OF AFRICA SHOWING CABLES OVER WHICH WAR NEWS IS RECEIVED.

The *Patent Office Gazette*, of November 21, is said to be the largest ever sent out, the drawings or illustrations alone taking up 322 pages. The volume contains the record of 535 patents, 59 of which were of one classification and issued to one assignee, all but four of the latter being granted to one applicant. These 59 patents alone contain 1,593 claims. The work of printing the volume was so heavy that an extra force of men was employed to allow its issue on schedule time.

NEWS FROM SOUTH AFRICA.

HOW THE WAR NEWS FROM NATAL REACHES NEW YORK.

Perhaps the principal topic of interest in the public press to-day is the conflict now raging in Natal, in the extreme southeastern part of the African Continent. No one who reads the newspapers can have failed to notice the sparseness of the news that has been arriving lately. This has been largely due to the fact that one of the two cables which are used to bring in intelligence from the South African States has lately been out of order, and has only just been repaired and put in working condition. The course of a cablegram from London to the scene of war is over a curiously complicated system of cables. Going first from a point in the southeast of England to Lisbon, the cable loops around to Gibraltar. The alternative route is offered *via* the French land lines to Marseilles, thence to Algiers, thence by a land line to Bora, in Tunis, thence by cable to Malta, which is also connected by two British cables with Gibraltar. Malta, in the middle of the Mediterranean Sea, is a sort of distributing point for cable lines, one running thence to Zante in the Greek Archipelago, and another southward to Tripoli. From Malta two cables run eastward to Alexandria, and thence a short cable line connects with Port Said at the northern extremity of the Suez Canal. From Port Said to Suez alongside the canal runs a land line, and at Suez four cables are led down the Red Sea, touching in at Suakin on the west coast and Jiddah on the east coast, to come together again at Aden, whence runs a single line of cable around the eastern extension of the African Continent, Cape Guardafui to Zanzibar, a port on an island on the southeastern coast. From Zanzibar two cables run southerly along the coast to Mozambique, from which point one cable runs to Lourenço Marquez, on Delagoa Bay, in Portugese South Africa. One other cable from there to Durban or Port Natal completes the circuit of cables down the eastern coast of Africa. At Durban are land lines

running through Pietermaritzburg and parallel with the coast to Port Elizabeth and Cape Town. The majority of the news that comes from the scene of war comes *via* Pietermaritzburg, and this eastern cable which, through the fact that north of Aden it connects with several lines leaving European points, gives the fastest service. There is, however, an alternative service which, beginning at Cape Town, runs around Africa in the other direction. It touches first at Port Nolloth, its second port being Mossamedes in Portuguese West Africa thence going by short loops up the coast to St. Paul de Loanda, Bathurst and Santa Cruz de Teneriffe in the Canary Islands. From that point a direct line of cable runs to Cadiz. Another cable from Bathurst runs to St. Vincent in the Cape Verde Islands, which is also connected with Funchal in the Madeiras and Lisbon, Portugal. This route up the west coast of Africa, on account of the shortness of the various lengths of cable and the necessity for relaying and retransmission at numerous points, is considerably slower in its working than the east coast system.

Dr. Arthur E. Kennelly, president of the American Institute of Electrical Engineers, who was formerly connected with the electrical service of a British submarine telegraph company operating in these parts, very kindly furnished the ELECTRICAL REVIEW with the above data. Dr. Kennelly was in charge of the laying of several of the loops of cable up the east coast, and is very familiar with the ground, or rather with the sea-bottom, on which they lay.

The total capacity of the whole system is not over 25 or 30 words a minute on both routes. The cable rates from New York to Ladysmith, Natal, are $1.23 per word. A reference to the map on page 339 shows very clearly the situation of the cable system in South Africa.

It is stated that the street railway companies in Albany and Troy, N. Y., will soon be consolidated under the name of the United Traction Company. This is said to be the forerunner of a consolidation of trolley roads, which will give a continuous line from Albany to Lake George *via* Mechanicville, Stillwater, Schuylerville, Saratoga, Fort Edward, Glens Falls and Caldwell.

A rumor is current that the Whitney-Widener-Elkins syndicate has secured a controlling interest in the Hudson Telephone Company, of Jersey City, N. J.

BRITISH NOTES.

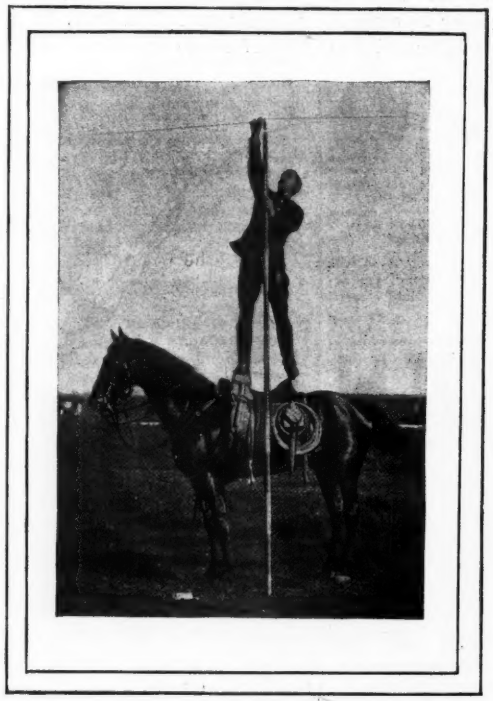
[From our special correspondent.]

The opening address delivered by Sir Douglas Fox before the Institute of Civil Engineers, is noteworthy, and for some reasons especially so. He had much to say upon the well-worn but perennially important topic of the decadence of British industry, or better, perhaps, the failure of Great Britain to retain her formerly unquestioned supremacy in the markets of the world. But he was particularly severe upon our failure to keep pace to any extent with the electrical progress of the rest of the world. We had, he said, a few miles of electric tramways, and a few more projected, but the disproportion between ourselves and other civilized nations in this particular was ludicrous. Electric lighting had done better, but even in this respect the success was but qualified; and there were still to be found reactionists in favor of gas. In London a series of costly experiments were being solemnly conducted to test the suitability of electric traction for railway work; regardless of the circumstance that the problem has already been solved half-a-dozen times over abroad, and that in America alone that suitability has been demonstrated beyond cavil. Meanwhile the patient Londoner continues to be asphyxiated in the noisome tunnels of the underground railway system, which should have been cleaned and ventilated and adapted to modern needs and conditions long since. Finally our technical education was a farce, and would not bear comparison with the great state-aided and state-controlled methods of Germany and elsewhere. Altogether the outlook, to his mind, was not hopeful.

One of the eminent engineers who has been retained to assist in the farce of the traction experiments upon the underground railway was in the audience which listened to Sir Douglas Fox's address. I have often wondered what view he takes of the question which he has to redecide—if one may use such an expression. Of course, if he is paid a handsome fee to carry out a series of costly experiments to demonstrate a foregone conclusion, and a conclusion which his employers well know to be foregone—nobody can blame him if he humors them, but the position is scarcely a dignified one, nevertheless. He is not responsible for the policy of wasting the funds of the companies to throw dust in the eyes of the public, and to defer the expense of converting the line to a system of electric traction; but it is not pleasant to see an eminent man even associated with it upon such terms; and, though little is said upon the subject in electrical circles, I know that much is thought, and of this Sir Douglas Fox's severe observations are by no means a far-off echo.

The *Times* of a day or two ago contained a very interesting lecture from Dr. Oliver Lodge, whose name is well-known to electricians all over the world, suggesting a method of opening communication with Ladysmith by leakage currents, which he thinks might be improvised with materials on the spot, and would certainly serve for the sending of slow messages. You will remember, perhaps, that such an arrangement was used some years ago when the Paris telephones were disturbed by a mishap on the Deptford mains. There is to be a wire earthed at each end running east and west across Ladysmith, another parallel to it and as long and near as possible; an alternator and signalling switch in each circuit for sending and receiving, a telephone and condenser in each. Of course, this all sounds very nice in print, and doubtless in the quiet of Dr. Lodge's study it would not be difficult to give effect to his suggestions, but between Boers and Lyddite shells and trifling disturbances of that character, our military scientists may well be excused if their inventive genius is not quite equal to the occasion.

Another interesting lecture lately delivered, has been that at a recent meeting of the Glasgow and West of Scotland Technical College and Scientific Society, where Mr. R. S. Manford read a paper on "Acetylene Gas, Its Manufacture and Use." The first thing he had to tell his hearers was,



FIGS. 1 AND 2.—BRITISH TELEGRAPH CORPS IN SOUTH AFRICA.
STRINGING WIRES. MAKING A JOINT.

that it is by no means so new a discovery as is popularly believed, seeing that there is authentic evidence of its being used by a French chemist in the early fifties. The real point in the modern discovery was the possibility of producing it cheaply by bringing fused coke and lime into contact with water. The interest of it to electricians lies, of course, in the fact that it can only be economically produced by the assistance of electricity, the electric current being called in to aid in producing the gas, which, as some people confidently assert, will some day oust it from the market for lighting purposes. To my mind the principal objection to acetylene, and the one which will most weigh with practical people, is the exceedingly evil odor which emanates from it, and which in uninstructed neighborhoods would infallibly bring the sanitary inspector and his myrmidons on the spot in force whenever any slight leakage occurred. I do not know whether it is the case with you, but among us it has come into considerable favor for use in bicycle lamps, but then bicycle lamps are mostly used out of doors, where the effects of the gas are not so pronounced.

The Glasgow people are rejoicing in another section of their tramways having been electrically equipped, and it is confidently hoped that the whole city will be traversed by electric tramways before very long. The trouble about the contracts appears to have simmered down for the time being, and it is to be hoped that we shall hear no more about it.

I think I mentioned to you a week or two ago that the Monorail Electric Railway, which has been projected between Manchester and Liverpool, was on the way to becoming an established fact; another step in that direction has been taken by the formation of a powerful financial engineering syndicate, with a large capital, which really intends to go through with the business. The contract for the work will be given to Messrs. Mather & Platt, the well-known electrical engineers, and in their hands you may be sure that, if it is possible to make a good job of it, it will be done.

London, November 17.

OBITUARY.

Julia Marsh Jewell, wife of the president of the McIntosh Battery and Optical Company, of Chicago, died at her home, November 21. The sympathy of the electrical fraternity is sincerely accorded to Mr. Jewell in his bereavement.

The British Army Telegraph Corps in South Africa.

It has been stated that the English Army Telegraph Corps has reached a higher state of perfection than any similar body, and the present campaign in Natal will serve to prove or disprove the correctness of this assertion. There is no doubt, however, that the telegraph battalion of the British regular army is a superbly drilled and trained body of men, who should show the highest efficiency. The battalion is partly mounted, the mounted men carrying cavalry carbines, while the dismounted members are armed with artillery carbines and sword bayonets. The horses of the mounted corps are especially trained for the difficult service expected of them, the character of which may be judged from the accompanying illustrations. For these we are indebted to the courtesy of our esteemed contemporary, *Leslie's Weekly*. The illustrations show a group of volunteer telegraphers with their field equipment, also another group on a practice march receiving a message in the field. The illustrations showing the mounted men are of the most interest. It will be seen that the rider stands on the back of his horse to attach the wire to the lance-like pole, whose sharp end is driven in the earth, while another illustration shows one of the well-trained horses standing on wire reels in order to gain the necessary height for his rider to make a joint in the wire.

FIG. 3.—BRITISH TELEGRAPH CORPS IN SOUTH AFRICA. VOLUNTEERS WITH FIELD EQUIPMENT.

In the Dongola expedition of 1896, the telegraph battalion kept up with the marching troops and had a line laid to each place of encampment by the time the troops had fairly established themselves in it. The wire in that campaign was carried in reels on camels' backs. In the South African campaign the wire will be carried in the usual way on light-wheeled reels or else on muleback. Those who have impatiently awaited news from the front for the last few weeks, will readily understand the enormous importance that will attach to the operations of the field telegraph corps accompanying General Sir Redvers Buller in his forward movement through the Natal district, where the enterprising Boers have destroyed all lines of communication. To-day the only messages that come out of the beleaguered towns of Ladysmith and Estcourt arrive either by pigeon or by a native messenger who lurks in the veldt by day and takes his chances at eluding the Boer guards at night.

FIG. 4.—BRITISH TELEGRAPH CORPS IN SOUTH AFRICA. RECEIVING A MESSAGE IN THE FIELD.

In this connection it should not be forgotten that the telegraph service corps at present with the three divisions of the United States Army, operating in the Philippine Islands, has kept well up to the front through probably as difficult a country as ever such lines were worked in. They have had to contend with deep streams, bogs, great and torrential rains, high winds and a vigilant enemy strong in guerilla tactics and dearly loving to break up a line of telegraph communications. Their success has been most creditable, and when the full details of it arrive it is certain that the record of this corps will be one in which American engineers can take just pride.

American Marconi Wireless Telegraph Company.

At Trenton, N. J., on November 22, a charter was granted to the Marconi Wireless Telegraph Company with an authorized capital of $10,000,000. Mr. Isaac L. Rice, well known as former president of the Electric Storage Battery Company and of the Electric Vehicle Company, will be the president, and Mr. August Belmont, the treasurer. In an interview with a newspaper Mr. Rice is reported to have said :

"Active operations will be begun by the company as soon as we have obtained suitable quarters and have built our machinery. Probably our factory will be in New York. The company has acquired the right to operate in all the American possessions and in Cuba. There was a contract made recently, prior to the formation of our company, to connect five of the Hawaiian islands by wireless telegraph, but otherwise we will control all Hawaiian wireless rights. There are all sorts of uses to which the Marconi system can be put, and it is really in its infancy.

"Among the matters to which we will give special attention will be the manufacture of instruments to be used for telegraphing between vessels at sea. We hope also to equip with wireless telegraph instruments the signal and life-saving stations along the coast, so that approaching vessels can be warned when fog and storm hide them and their lights."

SCIENCE BREVITIES.

Effect of Heat on Sparking Distances—A striking experiment in this connection is described by F. J. Jervis-Smith in the *Philosophical Magazine*. The pointed conductors of the secondary wire of a 10-in. induction coil were separated till a spark would not pass and only a faint brush was visible; on bringing the flame of a spirit lamp near one of the points, a torrent of sparks instantly bridged over the space between the points. When the flame was removed the sparks ceased, and they were restored each time the flame was brought back. But this was not the case when the flame was brought into a similar position with respect to the other point. The application of the flame did not cause the sparking to bridge across the space between the points, but on reversing the direction of the primary current the sparks crossed as before. The nature of the discharge was then tested by applying an X-ray tube, and the point effected by the flame was found to be the cathode pole. The effect was only obtained with an electrolytic break in the primary circuit, and with points instead of balls as spark terminals. This is probably the first case observed in which heat has a well-marked differential effect upon the two poles. The author supposes that heated particles are projected from the cathode and form a bridge across the gap, whereas no such particles are projected from the anode pole.

Range of Observable Phenomena—A highly suggestive contribution to the general survey of physical science has been made by Mr. G. Johnstone Stoney, says an abstract in the *Electrician*. He classifies the various measurable distances under four groups, as stellar distances, planetary intervals, laboratory measures and molecular quantities, respectively. Each of these stands to the next in the ratio of 10^{10} to 1. The uttermost region of the visible universe accessible to our telescopes is probably 10^{21}m. away. Light takes some 100,000 years to reach us from there, and, when the white spot flared up in the nebula of Andromeda some time ago, we were probably witnessing an occurrence which happened during the neolithic period. Light, by its wonderful speed, brings these enormous distances within our grasp. It also brings us into touch with extremely minute intervals by the smallness of its wave-lengths. The smallest distances with which we can even theoretically deal are larger than 10^{-12}m., and comprise the intervals concerned in events within atoms. A further subdivision is, to us, meaningless. The known universe, then, is comprised between the limits of ultra-stellar remoteness and infra-molecular proximity. Large as the range is, it might be infinitely larger in both directions. Mapped out as it is by the author, it resembles nothing so much as an absorption band in a spectrum, representing that portion of the material universe which happens to be accessible to human faculties.

Analysis of Spark Discharges—The mutograph, or mutoscope camera, has been utilized by J. H. West, for obtaining some capital records of sparks yielded by a Wehnelt interrupter, says the *Electrician*. As ordinarily used, the mutograph film is arrested in its motion during the short interval required to take the picture. The author, however, let the film move at a uniform rate, and so obtained a large number of successive spark pictures. Some of them have a thicker track than others, but the author believes that the thicker ones are composed of a large number of separate sparks nearly superimposed. In some cases such multiple sparks could be seen to consist of several distinct tracks. That these were successive and not simultaneous was proved by the fact that the distance between the nearest points of the tracks would vary with the direction of the track, being smallest where the track most nearly coincided with the direction of motion of the film. The irregularity of the action of the Wehnelt interrupter is proved by the variations in the intervals between successive sparks, but it is already made evident to the ear by the absence of a musical note of constant pitch. The author estimates the thickness of a spark as varying between 0.2mm. and 2mm. He also proves that sparks lasting only one-millionth of a second are capable of producing a visual sensation.

Magnetic Properties of Alloys of Iron and Aluminum—At a recent meeting of the (British) Physical Society, Dr. S. W. Richardson read a paper on the above subject. Observations were made upon four alloys containing, respectively, 3.64, 5.44, 7.89 and 18.47 per cent of aluminum. The alloys were used in the form of anchor rings, and were wound with primary and secondary coils, separated by asbestos paper. The temperatures used ranged from—83 degrees to 900 degrees centigrade. The low temperatures were produced by the rapid evaporation of ether, surrounded by ice and salt or by carbon dioxide snow. The high temperatures were obtained either electrically or by gas muffles. In both cases the actual temperatures were deduced from the resistance of the secondary, which was made of platinum wire and wound next the metal. The author employed Maxwell's mill method of measuring mutual induction, increasing the sensitiveness by the introduction of a secohmmeter, making about three revolutions per second. In order to test the accuracy of the method, some of the experiments were repeated with a ballistic galvanometer in the ordinary way, and the agreement obtained between the results in the two cases was well within the limits of experimental error. The chief conclusions to be drawn from the experiments may be summed up as follows: (1) The alloys behave magnetically, as though they consisted of two distinct media superposed. (2) The general roundness of the curves and their lack of abruptness near the critical point seems to indicate that the alloys are heterogeneous in structure. (3) The permeability decreases with rise of temperature near the critical point until a minimum value is reached, when further rise of temperature produces very slight diminution, if any, in the permeability. (4) The experiments suggest that the maximum value of the permeability for an alloy containing 10 per cent of aluminum is reached at about 90 degrees centigrade. (5) An alloy containing 18.47 per cent of aluminum has a critical point at about 25 degrees centigrade, and gives no indication of temperature hysteresis. This alloy probably has a maximum permeability much below — 90 degrees centigrade. The author has found that, at high temperatures, there is a second maximum in the induction curve. This maximum becomes less and less noticeable as the field is increased.

Dispersion of Cathode Rays—When a narrow beam of cathode rays is deflected by a magnetic field some of the rays are more deflected than others. Birkeland, using an induction coil for producing the rays, observed that the deflected rays produced several successive phosphorescent patches, which he described as a magnetic spectrum. Since the deflection of the particles composing the rays depends upon the velocity with which they are projected, and also upon the ratio e/m of the electric charge to the mass, it is interesting to determine which of these factors it is that varies from one part of the spectrum to the other. Some light is shed on this subject by an important observation made by R. J. Strutt, that in the same vacuum tube a magnetic spectrum may be produced with an induction coil, whereas all the rays are deflected to the same extent on substituting a high-potential battery for the induction coil. The single patch remains a single patch, and is, if anything, more sharply defined than before. This indicates that it is probably the velocity of the particles which changes, and not the ratio e/m. The velocity depends upon the difference of potential, and that is constantly changing when a coil is used. The author supposes, says Mr. E. E. Fournier d'Albe, that there are certain maxima and minima of velocity produced in rapid succession, and that the simultaneous observation yields the "magnetic spectrum."

Action of Light on Electro-static Charges—An English contemporary abstracts a paper by Herr Oscar Knoblauch on the above subject as follows: Many negatively charged substances when illuminated gradually loose their charge, as may be shown by connecting them with an electrometer. The author has examined numerous substances in this way, and finds that those which are sensitive to light have a special tendency to lose an electrostatic charge. The discharged electricity must be conveyed by ions either of the substance itself, or of the superficially absorbed oxygen. Only negative charges are lost by dissipation, hence the discharged ions must be negative, whether the substance is metal, sulphur, or glass. The author accordingly regards the dissipation as depending on an oxidation process, the loss of charge being effected by negative oxygen ions. In accordance with this view, oxidizable substances, such as sulphides and photographic developers, are found to lose their charges under the influence of light, whilst highly oxidized substances, like sulphates and permanganates are not affected. The fact, that certain substances, such as zinc, take a positive charge when illuminated, may be similarly explained. The oxidation of phosphorus is an analogous phenomenon.

Over $3,000,000 have been expended this year in connecting the Bell long-distance telephone lines with small towns east of the Mississippi.

THE ELECTRIC PLANTS OF THE BATTLE-SHIPS KEARSARGE AND KENTUCKY.*

BY NAVAL CONSTRUCTOR J. J. WOODWARD, U. S. N.

(Continued from page 331.)

The circuit-breaker consists of two independent single-pole switches, one for each pole. Between these is a single-pole switch, to be closed only when the generator is operating turret-turning motors, for short-circuiting the series field. At all other times it is open. There are also on this board terminals for the field connections, and at the top a pilot lamp protected by fuses, which is not cut out when the circuit is opened. The main switchboard, consisting of eight panels, is located on the splinter deck level, on the starboard side of the room, and extends athwartship. The outboard of these panels carries the instruments for common use with all the generators. The remaining seven panels are exact duplicates, each controlling one generator. All seven equalizer switches are on one board, located at bulkhead 41½, in the centre of the upper room. Each dynamo is connected with the panel or equalizer switch of the corresponding number. When facing the commutator of any generator the right-hand main cable is the positive, the middle the equalizer and the left-hand the negative. Two field wires are run from each generator to the panel, where they may be connected by means of field switches, either for the self-excitation of ordinary use or separate excitation when operating turrets.

All current for power and light (except that for the illumination of the dynamo rooms) is supplied through the three main distribution boards on the splinter deck, No. 1 forward, No. 2 amidships, No. 3 aft. Each of these main distribution boards is supplied by an independent set of feeders, which run directly to the busbars of the main switchboard. Each of the feeders consists of five wires, one of which is the neutral for both light and power, two of the others being the positive and negative for the power and the remaining two positive and negative for the lights.

The reason for thus dividing the feeder is to prevent variable loads on the power system from affecting the steadiness of the lights, but as the neutral carries but a small current the effect of having this common is inappreciable. The turret-turning motors are fed through the board amidships, No. 2, by separate feeders from the generator board. The lights are fed from these boards upon two-wire feeders and mains, and the switches controlling these individual circuits are distributed upon each side of the neutral, so as to give as nearly a balanced load as possible. The power is supplied, either directly to the motors, or through auxiliary boards located in the turrets, and upon the main and berth decks. Motors for turret turning, exhaust fans, rammers and elevators are run on 80 volts only. All the others are operated at 160 volts, but a switch is provided by which either 160 or 80 volts may be supplied, with the corresponding difference in speed.

Boards No. 1 and No. 3 feed the search lights, and the turning motors for both turrets are fed through board No. 2. The auxiliary boards are for power only, and are employed to give convenient centres of distribution, and reduce the number of wires which would be required if each motor were fed individually from the distribution boards.

The main distribution boards are of slate, supported by angle-iron frames. Boards No. 1 and No. 3 are each protected by a wire mesh guard which has doors conveniently located and supplied with locks. There are two independent sets of three busbars, the middle bar of each set connecting to the common neutral and the others being the positive and negative of the lights and power, respectively, except in the case of the turret-turning system, which is separately described. Every line leaving the board is protected by a fuse at the switch, except those for the searchlights, where circuit-breakers are used. Each switch is marked on the front of the board with a name-plate giving the circuit supplied, and on the back with the number of the circuit as shown in the diagram of connections and plans of electric light and power lines.

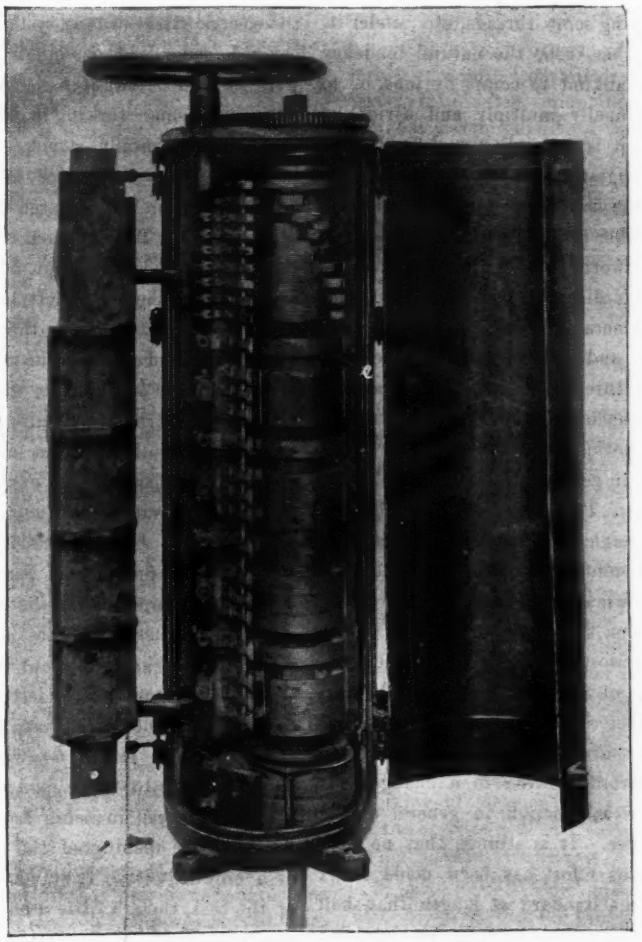


FIG. 2.—CONTROLLER OF THIRTEEN-INCH TURRET-TURNING MOTOR ON U. S. S. KEARSARGE AND KENTUCKY.

Distribution board No. 1 is located upon the splinter deck, near the outer wing bulkhead, and feeds four systems of distribution. These are: I. Incandescent lights. II. Searchlights. III. Communication signals. IV. Power.

The kind and use of the separate pieces of apparatus upon this board is as follows:

I. *Incandescent lights*: Battle lighting circuit for the forward turrets and handling rooms; battle circuit for the lights in the chart house, conning tower, running lights and signal lights on both masts; also non-battle circuit for lights under the fore and aft bridge; battle lighting circuit in the forward magazine and shell rooms; battle and lighting circuits supplying all lights on the protective and berth decks forward of the armor, and also the receptacles for the stay light and portables forward upon the main deck.

II. *Searchlights:* The apparatus for the forward searchlights and the individual light thereby controlled is all on this board. In the centre of the board is a double-pole potential switch to enable the voltmeter to be used with either searchlight. Below are two rheostats, on the left for the port light; on the right for the starboard light.

III. *Communication signals:* A switch supplies a feeder running to the communication room for operating steam whistles and other signal devices.

IV. *Power:* Exhaust blower in the crew's water closet; 5-inch ammunition hoist, starboard, on the platform deck; 5-inch ammunition hoist, port, on the platform deck; ventilating fans in the forward blower room; distribution board No. 1-A, main deck, frame 31, which feeds the forward boat cranes and deck winches on the superstructure deck; all the power in the forward 8-inch and 13-inch turrets, except that of the turning motors.

The description of the other boards must be omitted for want of space; but considering the number of circuits brought to this board alone, the advantage will be seen of concentrating such circuits on the various main and auxiliary distribution boards, and supplying the current through feeders, as described, with the attendant reduction of the number of holes in watertight bulkheads and in total length of the distributing circuits.

The lights upon these ships are divided into two classes—battle and lighting. Battle lights are, in general, those which can not be seen from

(Continued on page 346.)

*Abstract of a paper read before the Society of Naval Architects and Marine Engineers, New York, November 16, 1899. (See also article on the electrical equipment of the Kearsarge in the ELECTRICAL REVIEW for September 27, 1899.)

Electrical Review

OLDEST ELECTRICAL WEEKLY IN THE UNITED STATES.

TIMES BUILDING, 41 PARK ROW,

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THE METRIC SYSTEM.

In our last issue was a discussion of the advantages and disadvantages of the metric system, which is interesting but somewhat inconclusive, and which does not take into consideration one of the most serious objections to the general adoption of that system for ordinary use. The great difficulty that has been encountered on the continent of Europe in working with the metric system is the seemingly hopeless task of standardizing screw threads, etc., under it. Whether it be the natural tendency of mankind to count by tens, or to continually multiply and divide by two, it is certainly very difficult even to suggest any satisfactory subdivision of the centimetre for screw threads. Another important point is that the Whitworth thread, in inch sizes, is standardized all over the world, that innumerable screws and bolts and taps and dies are in existence with such threads, and that practically all the machinery that is now at work in the world is dependent for repairs upon ease in getting standard sizes of these goods. To change them would involve mechanical confusion for a generation, and even to-day, in Germany, notably, where machinery is made on the metric system, the screw threads are cut to Whitworth inch gauges. The difficulty of adopting the centigrade thermometer scale is apparently not a difficulty at all, but involves only the awkwardness due to a change. It gives satisfaction in general use in France. It is strange that no more serious effort has been made to fix upon a standard of length that shall be really what the metre was intended to be—fixed and immutable, and rediscoverable if lost. Such a standard is found in the wave-length of light. This can now be measured with extreme accuracy, and it could be made the basis of practical standards approximating either the metre or the foot. Some suggestion of this sort has been made, we believe, by Professor Michelson, but nothing practical has been done toward adopting this most scientific unit of length, except in refined physical research work.

THE DANGERS OF GAS.

As is described elsewhere in this issue, a violent explosion of gas took place in an excavation on Broadway, in this city, a few days ago, resulting in the death of one person, the wounding of many and the destruction of a considerable amount of property, mostly in the shape of window glass. From the accounts in the daily newspapers it appears that the excavation, which was being made for the installation of new ducts for the electric street railway system, uncovered some old gas-pipes which were said to be out of use. At any rate, when a man working in confined quarters accidentally struck an old four-inch pipe with his pick, he made a hole in it from which a large volume of gas escaped. The workmen realized their danger and rushed out, but just as the last of them had left the excavation, a lighted lamp that had been left behind exploded the mixture of air and gas in the hole, with the fatal and destructive results above noted. There have been a good many manhole and conduit explosions in New York city, many more than there seems to be any necessity for. The constant presence of leaky and defective gas-pipes under the soil of our cities, where they are covered with an impervious pavement, affords an ideal opportunity for a destructive and dangerous flow of gas into almost any excavation. It adds a new danger and difficulty to the already great ones encountered in doing any work requiring the opening of the streets of a crowded city. It stands as one of the best, though little used, arguments in favor of a complete and thorough subway system, in which pipes can be cared for and looked after, and by the use of which such dangers may be entirely eliminated.

It is curious that electric railway managers, who have so practically stimulated invention in all directions concerned with starting cars and keeping them moving, have done so little for the equally necessary devices used in stopping them. Compare the controller of a modern electric car with the ancient hand-brake, which is to-day just the same as that used by the late George Stephenson in the memorable trials of the Rocket in England some two-thirds of a century ago. There is no need to call the attention of any observing man to the growing necessity for better brake systems on the large and heavy cars, from which the exigencies of transit requirements in American cities demand high speeds. The most elaborate mechanism of highly perfected operation is used to start the car and keep it running, but when it is to be stopped recourse is had to a most inefficient, slow-acting and unsatisfactory means. The hand-brake on the modern street car is not only an anachronism—it is a danger.

Not long ago when a salesman approached a buyer he used every effort to cultivate friendly relations, to expatiate upon the merits of his goods and to make a sale of them. Nowadays it is the humble buyer who hunts the salesman and does his best to cultivate relations of such friendliness that he will be permitted an opportunity to get the goods that he needs at any price. This statement, which is true, was made the other day by a prominent manufacturer, and epitomizes with great exactness the present unprecedentedly prosperous trade situation.

On another page in this issue is an interesting article upon the electrical equipment of the lines of the Manhattan Railway Company, in New York city, by Mr. B. E. Greene, formerly editor of *Electricity* and a frequent contributor to the *Engineering Magazine*. Mr. Greene's great familiarity with the commercial side of electricity lends weight to his conclusions, that the change from steam to electric power on the elevated railways is advantageous.

Carbon making, an industry growing directly out of the increasing uses of electricity, is an interesting process. The illustrated description of it on another page will be found of particular interest, because the art has been written about very little, and few of the many users of carbon have any idea of how it is made or what materials are used in its manufacture.

THE BERLINER PATENT SUIT.

A REVIEW OF THE ARGUMENTS OF COUNSEL IN THE BERLINER SUIT.

The history of the long legal warfare over the fundamental patents of the telephone, may be brought to a close by the decision of the United States Circuit Court for the district of Massachusetts, in two suits which are now pending before it. It will be remembered that the suit in the United States Supreme Court, which was brought to annul the Berliner patent, alleged grounds of fraud in its grant by the Patent Office authorities, which were not sustained. That famous case, however, did not concern itself with the validity of the patent on physical and technical grounds, the effect of the decision being to validate the issue of the patent without discussion of its merits. Under this patent which covers pretty broadly the telephone transmitter, suits were brought by the American Bell Telephone Company against two concerns; the National Telephone Manufacturing Company and the Century Company, both of Boston, and both of whom were manufacturing telephone goods which were alleged to infringe the Berliner patent. The two cases have been considered as one, being practically identical, and an array of the ablest counsel has argued the matter at length. The plea of the defendants has been that the Berliner patent is invalid.

The argument in the suit now pending in Boston, was opened by Mr. Frederick P. Fish, of counsel for the complainant. His argument, beginning with the admission of infringement, proceeded to the contention that the Berliner application was never unlawfully amended in the Patent Office; that the liquid transmitter, briefly referred to in Bell's patent of 1876, was not a microphone, and that the contention that Edison had anticipated Berliner is incorrect. Another claim of the defendants, which Mr. Fish attacked, was that a patent dated November 2, 1880, and granted to Berliner, invalidates the claims of his patent now under consideration, which was granted eleven years later. Counsel stated that the reason why Berliner did not apply for foreign patents on his transmitter invention was, because during 1876 and the two succeeding years he earned too small an income to pay their cost. After selling this patent to the Bell company he was enabled, by reason of the large sum received for it, to apply for foreign patents for his subsequent inventions.

Mr. Edward P. Payson, of counsel for the National Telephone Manufacturing Company, made the claim that even if Berliner had produced his metal transmitter earlier than the carbon transmitter of Edison, yet, in view of the latter instrument and the preceding state of the art, the Berliner patent, if valid, is of very limited scope, and not infringed by the defendants.

"The purpose of the bill," said Mr. Payson, "is to continue complainants' monopoly of the commercial carbon transmitter. Their contention is understood to be that Berliner was the first inventor of a new method and apparatus in telephony, whereby pressure of sound waves upon the diaphragm varies the contact and pressure between electrodes in constant contact, and thereby varies accordingly the amount of current passing to the receiver. The three alleged novelties of their case are constant contact, variable pressure and transition resistance. The defendants first briefly controvert the construction put upon the patent by complainants, and also submit the general situation arising from the controversy over Mr. Bell's patent, its monopoly of carbon, the great value of that monopoly, and the propriety, in view of the great interests at stake, of confining the complainants' use of presumption arising from the grant of a patent strictly to the subject matter of such method of proof, and of requiring proper and sufficient evidence of the alleged breadth and scope of the invention depicted and described in the patent."

Mr. Payson argued at length that the Bell liquid transmitter operated practically upon the method patented by Berliner, and that hence the fundamental patent of the latter becomes merely a secondary device patent under the former. Two other points of considerable interest were taken up by Mr. Payson. First he argued that Edison did the real work of making the carbon telephone practical. Consequently he raised the point that if Berliner had never experimented in telephony that art would have been the same in June, 1877, and also would be to-day precisely where it is now. Therefore, he contended that nothing could be found in the defendants' carbon transmitters of which Berliner was the inventor.

Mr. J. E. Maynadier appeared in behalf of the Century Telephone Company, and argued first on the lack of equity in the Bell company maintaining a monopoly of the telephone for thirty-two years. Mr. Maynadier's argument was largely technical, concerning points of Patent Office practice.

Judge R. S. Taylor, of Fort Wayne, Ind., appeared by consent for his client, the Williams Electric Company, and argued at length on the virtual similarity of Bell's liquid transmitter and that described by Berliner. He cited the appearance of a description in the Philadelphia *Press*, of July 9, 1877, clearly setting forth the Edison carbon microphone, this date being prior to Berliner's amendments of his patent covering the means for transmitting articulate speech. Judge Taylor also argued that Berliner's patent of 1880, by reason of its description of both transmitter and receiver, invalidated, upon its expiration, the second patent for the transmitter alone.

The closing argument for the complainant was made by Mr. Frederick H. Betts. This contention was purely against the claims of similarity between the Bell and Berliner transmitters. In closing his argument, Mr. Betts said:

"It has been stated in the course of the arguments on the other side, that 75,000,000 people are the defendants in this case, which makes it the most stupendous on record. Even if this be true, I know of no presumption of law or fact arising therefrom which should sway this court either way in the matter. I suppose that the true interests of the 75,000,000 people of the United States will be best conserved by the administration of exact justice, regardless of who are defendants or complainants in the case."

Two weeks were allowed by Judge A. L. Brown, who heard the case, for the filing of supplementary papers, and the decision will be reserved.

PERSONAL.

Mr. E. H. Mullin, of the General Electric Company's New York office, has returned to his duties after a pleasant vacation spent in Bermuda.

Dr. Otto Thorsch, general manager of the Vienna factories of Schiff, Jordan & Company, has been in this country some days in conference with the managers of their American branch. In an interview Dr. Thorsch said that his visit was in regard to the great growth in the consumption in this country of his company's carbon products.

It is stated that Nome City, on the shores of the Arctic Ocean, in Alaska, is to have an electric light and street railway plants.

AUTOMOBILE NOTES.

It is stated that at the bicycle show which will be held in Madison Square Garden, New York city, during the week following January 20, 1900, the largest collection of automobiles ever exhibited in the United States will be on view. Makers of parts, as well as manufacturers of vehicles, are rapidly engaging the available space.

It is said that the New York Electric Vehicle Transportation Company is about to fit up the stables at Sixth avenue and Fiftieth street, New York, as a general supply depot and repair shop for its electromobile cabs, and will also establish in various parts of the city branch depots at which the storage batteries of its vehicles may be recharged. The company will also, it is understood, before long add several gasoline motor cabs to its equipment.

An arrangement was effected last week by which the Electric Vehicle Company got control of the business of the Pope Manufacturing Company in Europe. This arrangement includes a working agreement with Ludwig. Loewe & Company, of Berlin, for Germany and Austria, by which the Electric Vehicle Company will get a handsome royalty on all the gross business in automobiles of this firm. They will use the American designs to some extent. The Electric Vehicle Company, in France, is now starting a transportation company on the same lines as those followed in organizing those in this country. This company, which is known as l'Electromotion, is licensed by the Electric Vehicle Company. In addition to this company the Electric Vehicle Company will open general offices in Paris. Mr. Hart O. Berg, formerly with the Pope Manufacturing Company, will be the general manager.

The Electrolytic Gold Bubble.

The Electrolytic Marine Salts Company, of Boston — the Reverend Brother Jernigan's scheme for extracting gold from sea-water and from the pockets of the deluded — has again turned up, a final dividend of 6 per cent having been declared for the stockholders out of the various assets which were found when the company's business was wound up. This makes a total dividend of 36 per cent that the stockholders have received and, as much of the stock was bought below par, it represents about half of the money that was paid in.

THE ELECTRIC PLANTS OF THE BATTLE-SHIPS KEARSAGE AND KENTUCKY.

(Continued from page 345.

the outside. They include all lights below the protective deck and such above it as are necessary for the operation of the ship in action. All battle lights above the protective deck which might be seen from the outside, are controlled by individual switches and may be extinguished, or covered so as to be invisible. These include all running and signal lights and battle lanterns.

The lamps upon the lighting section are such as are required for illumination, under ordinary service conditions, in addition to the battle lights. Each main is controlled by a switch, either at the switchboard or at the feeding centre, by which it may be entirely cut out. All circuits, with the exception of that for the illumination of the dynamo room, are supplied from a main distribution board. Each of the feeders for these circuits is controlled by a switch at the distribution board, and supplied ordinarily by one of the mains, the character of the feeder, whether battle or lighting, thus determining the character of the main. Wherever possible the mains have been subdivided, so that only small sections shall be dependent upon one fuse, which will open the circuit in case of trouble without disturbing the other lights supplied by the same feeder. This should prevent the fuses on the main distribution board from opening the feeder circuit, if trouble occurs beyond one of the branch fuses, the only reason for the operation of the main fuse being the failure of the branch fuses to act, or an accident to the feeder itself. The mains are generally run in loops fed at one point through junction boxes, so arranged that each end of any main is protected by fuse of sufficient capacity to carry all the lights upon it. A double-pole switch is inserted at about midway between the fused ends, which, when open, separates the main into two independent parts, each protected by a set of fuses. If trouble occurs on one of these and its fuses operate, no lights on the other part are extinguished. As soon as the cause of the trouble has been removed, the double-pole switch may be closed, thus feeding the entire main through the uninjured fuses of the other section until the destroyed fuses can be replaced.

An exception to this method of protection occurs in the circuits to the magazines forward and aft where unfused feeder boxes are used, and ultimate dependence placed upon the main fuses at the distribution board.

Single lights are ordinarily protected by an independent set of fuses, but in conduit work one pair of fuses frequently supplies two lights, although care is taken that a portable and standing light shall not ordinarily be dependent upon the same set, although two portables are frequently so protected. In the case of duplicate lights in the same location, as, for instance, in the magazine boxes, running lights, etc., where the second is intended for reserve in case the first fails, both are never placed upon one fuse, although frequently each may be upon a fuse also supplying another light in a different location, *i. e.*, one starboard and one port side light are supplied through one set of fuses, and the second starboard and port lights through another pair of fuses.

Wherever wires enter the masts above the main deck, flexible couplings, consisting of heavy rubber hose, are inserted in the conduit, in order to allow the mast to move relative to the deck without injuring the protection for the wire.

The following brief description is intended to give a general idea of the character of the appliances used for controlling the electric current at the motor to which it is supplied, in such a manner as to produce the desired mechanical results of torque and number of revolutions per minute necessary for the mechanical operation of the auxiliary machinery driven. Two general conditions arise: 1. Where the motor must be reversed and its speed constantly varied during operation, as in the case of a boat crane, deck winch, etc. In this case the arrangement used is called a *controller*. 2. Where the motor runs constantly in the same direction and at a constant speed for long periods of time, but with the possibility of varying the speed when so desired, as in the case of a ventilating fan. In this case the arrangement used is called a *controlling panel*.

A controller is an arrangement for making the proper electrical connections between the main lines and a motor, so as to control the direction and speed of rotation. Those used on these ships consist, essentially, of the following parts: The frame with cover; cylinder or cylinders; contact fingers; blow-out magnet; arc deflector; star-wheel; cap-plate, and handle. The frame is made of cast-iron and provided with a removable cover, in most cases made of sheet iron, but in one case being made of brass. The cylinder is supported in bearings in the frame, and is operated by means of a suitable handle. On this cylinder are carried contacts, suitably insulated from the shaft and from each other, arranged to make the necessary combinations for the control of the motor. The outside surface of these contacts is cylindrical and extends through only a portion of the circumference. In the centre of this cylinder is a shaft which serves the purpose of supporting and operating the cylinder, and also serves as a part of the magnetic circuit afterwards described. Upon this steel shaft is supported either a wooden cylinder or a cylinder of specially made composition. On the outside of this are held castings made of brass, which, in the case of the wooden cylinder, are fastened by means of screws, and in the case of the composition cylinder, they consist of hollow cylinders entirely surrounding the special insulating composition, which, by the application of heat, has been made firmly to fill the interior of the hollow cylinder and secure it to the cylinder. In most cases, all those contacts which are to be electrically connected are made in one casting, there being, consequently, a less number of castings on the cylinder than there are contacts. The projections on this casting, after being turned to a true cylindrical surface, are supplied with copper contact rings, generally about 1 inch in width and ¼ inch in thickness, which have been shaped to a true cylindrical form and are fastened to the projections by means of two or more screws. These contact rings are thus made removable, so that in case of burning, or of any injury to them, they may be replaced by new ones.

On the wooden block supported by the frame are several contact fingers, insulated by the block from each other and from the frame. These fingers are stamped from copper, and are held in position by springs and adjusting screws, so that when the cylinder is rotated its contact rings will make firm contact with the fingers, the springs of which give sufficient pressure to insure a good electrical connection. The contact fingers are supplied with binding posts in which wires or cables are fastened, making the necessary connections between the line switch, motor, rheostat and solenoid brake, if used. In some cases these wires are carried directly out to the back of the frame, being insulated from it by rubber bushings, and in other cases the leads are carried down the inside of the frame and brought out through a hole in the bottom. The fingers are fastened in their bases by means of small screws, which readily permit of replacing any which may be injured. The adjusting screw is provided with a check nut, so that the screw will not jar loose after the finger has once been adjusted. The bases are fastened to the wooden block by means of screws, and the wooden block is fastened to the controller frame in a similar way.

In order to reduce the burning of the contacts, which would naturally result to some extent from the operation of the controller, a magnetic circuit is provided, which has the effect of instantly breaking the electric arc formed when any circuit is broken. This circuit is produced by means of a spool or coil surrounding the lower end of the cylinder shaft. In addition a steel pole-piece is supported over the fingers, being connected magnetically, at the bottom, to the bearing of the shaft, so that a magnetic circuit is formed, consisting of the shaft, bottom of controller frame, and pole-piece, the circuit being completed by the air space between the pole-piece and the shaft, forming a magnetic field along the end of the fingers. There is, of course, some magnetic field on the other side of the controller cylinder, between it and the back of the controller, but only that portion formed between the pole-piece and the shaft is used in blowing out the arc.

In one form of the controller the magnetic blow-out does not surround the cylinder shaft, but has a separate core cast to the back of the controller, to which is attached a pole-piece covering the contact fingers. In this case the magnetic field is produced between the pole-piece and the back of the controller, the cylinder being in the field and concentrating the magnetism on a line between the pole-piece and the shaft, which line is near the ends of the contact fingers. In the connections of the controller, the winding of this spool is in series with the armature of the motor, so that whatever current passes through the armature also passes through the blow-out magnet, and produces the necessary magnetism, which is therefore approximately proportional to the amount of the current used.

In order more thoroughly to insulate the fingers from each other and from the cylinder and pole-piece, strips of fireproof insulating material are provided, extending between the fingers and pole-piece, with division

plates extending from this plate between the fingers themselves, and, in some cases, an additional plate is provided between the finger bases and the cylinder. These insulating plates prevent the arc, when thus formed, from being blown from one finger to the next, thus making a short-circuit, which might otherwise occur, and thus impair the effectiveness of the controller.

In order that the operator may judge of the position of the cylinder while operating it, without looking at it, a wheel is fastened to the cylinder shaft, containing several notches, or teeth, which engage a roller, supported on the end of the pawl, which is pressed against the star-wheel by means of a spring. As the cylinder is rotated this pawl offers some resistance to the movement of the handle, and as it moves into the notches the effect is plainly felt by the operator, who should leave the controller handle only in the position shown on this pawl and star wheel, because it is at these points that the fingers make the best contact with the cylinder. Also the star-wheel gives the additional advantage of making a quick-break at the time of passing from one position to another, as the tension of the spring helps turn the cylinder after the roller has passed the point between two notches. On one of the controllers, as will be afterwards described, there is only one notch on the star-wheel to indicate the off position of the controller.

At the top of the controller is a base-plate containing stops to limit the motion of the handle and points to show the position of the cylinder. On some of these controllers the cap-plate is provided with a notch into which a latch on the handle will fall when the cylinder is turned to the off position, so that the operator, when quickly stopping a motor, will not carry the handle past the off position, and reverse the motor.

There are five different kinds of controllers used on these ships, divided into three general classes, according to the kind of work that they are to perform, and are arbitrarily designated as R, B, and P. The R controllers are rheostatic in their method of operation, and are used for the purpose of starting, stopping, reversing, and controlling the speed of the motors. They are particularly adapted for motors designed to carry a load in either direction.

The B controllers are those which are designed to give electrical braking. By this the electric solenoid brake used in some cases is not meant, as that is simply a mechanical brake electrically operated. But in the B controller the motor is made to run as a generator by the momentum of its armature or load, and in this way reduces its speed or stops itself. In this way the speed can be controlled within proper limits, no matter whether it is lifting the load or is driven by its load. This does not take place in the case of the ordinary rheostatic controller, in which case more resistance turned into the circuit will cause the armature to run faster when it is driven by its load, and there is no way of reducing its speed below its full-load speed.

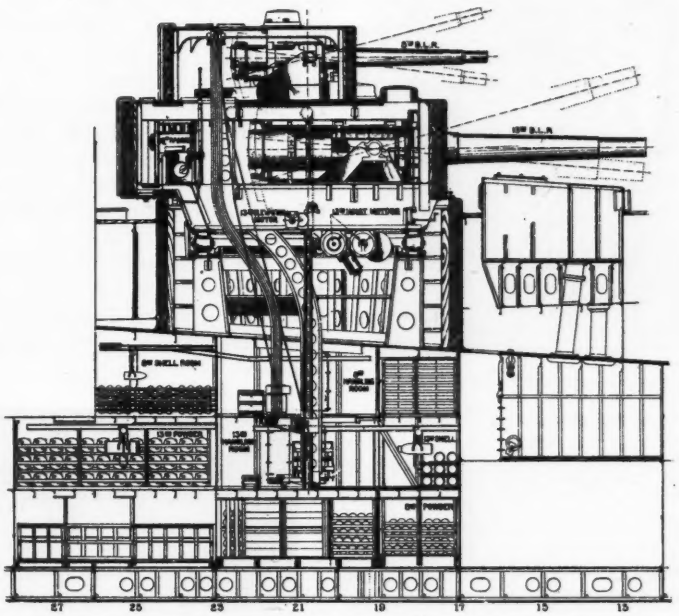


FIG. 3.—FORE AND AFT SECTION OF SUPERPOSED 13-INCH AND 8-INCH TURRETS, SHOWING TURNING AND HOIST MOTORS.

The P type of controller is used where the voltage of the generator is to be varied in order to obtain a change of speed of the motor, and is therefore called a variable voltage controller. There is only one kind of these controllers on these ships, known as the P 2, for controlling the rotation of the turrets. It is radically different from the other controllers, both in design and in system of control, although it retains the general features given in the general description, but the proportion and arrangement of its contacts are quite different.

The engine of the main generating sets (see illustration in ELECTRICAL REVIEW of November 22), is of the single-crank, vertical, tandem, compound, double-acting, enclosed type, and has a speed of 310 revolutions per minute at full load, with 100 pounds steam pressure and 25 inches vacuum exhaust. There is a heavy bed-plate bolted to the foundation supporting the engine and generator, and part of this bed-plate forms a reservoir for the oil used for lubricating the moving parts of the engine. The crank pit, which is enclosed by the column, is accessible through a large door in front of the engine, and a smaller one at the back. The range of steam pressure for this engine is between 80 and 120 pounds, but the normal as well as the most economical pressure is 100 pounds, and it is advisable to maintain this pressure. The lowest pressure at which this engine will carry full load is 80 pounds, with 25 inches vacuum. The engine will carry an overload of 50 per cent, and may be run on a steam pressure up to 150 pounds without any trouble.

The cylinders are 10½ inches and 18 inches, with a stroke of 8 inches. The cylinders are cast in one piece with the L.-P. cylinder on top. Both cylinders have relief valves, and are tapped for drain and indicator valves. The clearance in the H.-P. cylinder is 7½ per cent, and in the L.-P. cylinder, 7¼ per cent.

The shaft and crank are made from one solid piece of steel. Cast-iron counterbalanced weights are fastened to the crank opposite the crank pit, to balance the moving parts. The shaft on one end receives the governor wheel, and on the opposite end a flange coupling is secured for transmitting the power to the generator. A small eccentric, with ⅞-inch stroke, is turned on the hub of the coupling for driving the oil pump. The main bearings, two in number, are hollow, cylindrical, cast-iron shells, with flanges for bolting to the standard.

The governor consists of a heavy flywheel, keyed to the shaft and carrying the governor parts and the H.-P. eccentric. The governing mechanism consists of a single fly-weight, connected to a lever carrying the pin, which operates the H.-P. valve. The motion of the fly-weight is opposed by spring attached to the pulley. By increasing or decreasing the tension on this spring the speed may be raised or lowered. The same effect will be produced by moving the spring in the slot on the fly-weight. The system of lubricating the bearings in these engines is by forcing the lubricant under pressure to the various bearings.

The generators are compound wound for 80 volts, of the multipolar type, having 6 poles and an output of 50 K.W. with an armature speed of 310 revolutions. Each generator is bolted to a cast-iron base, to which is also secured the tandem, compound engine just described, and to the shaft of which it is directly connected. The magnet frame is a cast-steel ring made in two pieces, bolted together and carries six removable cast-steel pole-pieces, which are held in position by keys. Suitable lugs are cast on the lower half of the magnet frame for bolting it to the base.

Each double turret (see Fig. 3), is turned electrically, the method of speed control of the driving motors being entirely different from that of any other motor in the ship.

There are two fifty-horse-power electric motors, located below the floor of each 13-inch turret. These motors are regulated in speed and direction by a controller, situated under the sighting-hood, between the 13-inch guns. The operator has only to turn his controller-handle from the "off" position in the direction in which he wishes the turret to move, and the motors will drive the turret as desired, the speed of travel being dependent upon the amount which the handle has been displaced.

The method of control depends upon the fact that the speed of a motor armature running in a constant magnetic field is proportional to the volts impressed upon its brushes. Therefore by conveniently varying this voltage the speed of the motor is changed.

In this case each turret requires one

independant generator for the supply of the turning motors, but the dynamo switchboard is so designed that any generator may be used for either turret. The fields of the motors of the generator are separately excited from the switchboard busbars, and are consequently independent of the voltage generated by the armature of the dynamo. The field rheostat on the generator panel board is cut out, and in its place another rheostat in the turret operated by the controller is used, the generator field wires being carried to the turret for this purpose. The series coil of the generator is short-circuited by a switch on the headboard.

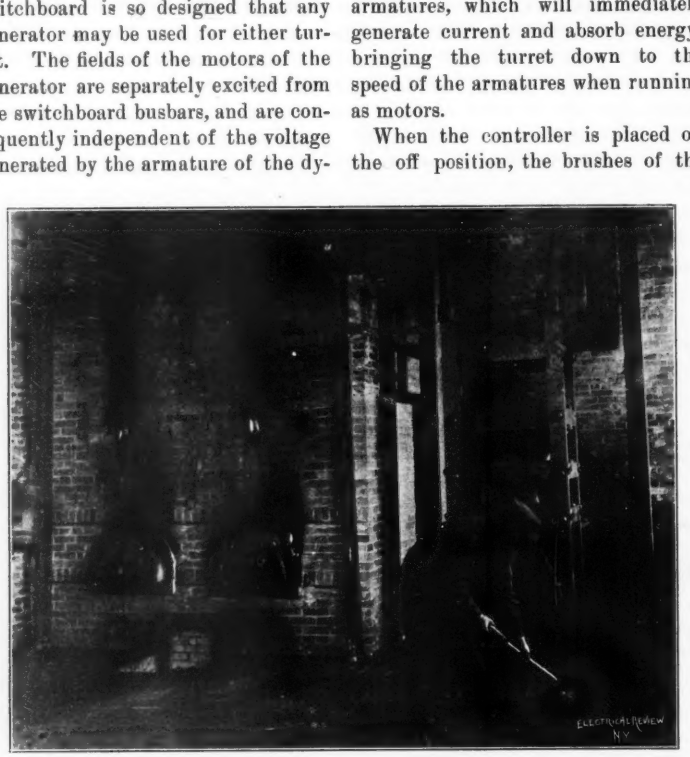


FIG. 1.—CARBON MAKING. KILNS FOR ROASTING THE COKE.

The armature terminals of the generator are connected through the necessary switches, etc., directly to the armature terminals of the motors. The motors are in multiple. As the engine drives the dynamo armature at a constant speed the volts delivered by it to the motor armatures are approximately proportional to the shunt field excitation, and consequently the speed of these armatures and of the turrets is directly controlled by the operator in the turret. This statement is correct, regardless of the mechanical resistances encountered, up to a load which causes the engine to slacken materially in speed.

The current required is dependent upon the turning moment necessary to overcome mechanical resistance, and will not vary greatly at any constant speed, regardless of what that speed may be.

If, when the motor is in motion, the controller is turned to such a position that the armatures would be driven as motors at a lower speed than that corresponding to the speed of the turret, the turret will drive the armatures, which will immediately generate current and absorb energy, bringing the turret down to the speed of the armatures when running as motors.

When the controller is placed on the off position, the brushes of the motors are connected through a low resistance, so that the armatures would generate large currents if revolved, thus requiring much expenditure of energy, which would be greatly increased by the mechanical connections from the turret, and thus electrically locks the turret. This condition does not hold unless the motor fields are excited.

(To be continued.)

American Association of Electrical Fan Manufacturers.

A number of electrical fan manufacturers, after a series of meetings held in New York city last week, have decided to organize the American Association of Electrical Fan Manufacturers. A provisional committee has been appointed, with Mr. H. Burd Cassel, of Marietta, Pa., as chairman. The chief idea aimed at is to secure uniform prices for electric fans. It is said that about $25,000,000 is the amount of capital involved in this branch of the industry, which is controlled by about fifteen firms.

New York Electrical Trade Association.

The fourth annual meeting of the New York Electrical Trade Association will be held at the Astor House, on Wednesday, December 6, at two p. m. A full attendance is requested. An "Advance Information" plan will be presented for consideration.

Wall Street and the Electrical Stock Market.

Owing to the fact that the stock exchanges were closed on Saturday, November 25, on account of the funeral of the late Vice-President Hobart, our market report is brought up to Monday, November 27. It was expected that the showing made by the clearing-house banks on Saturday would stimulate speculating on Monday, but the action of the market was disappointing. The favorable bank statement was offset by the London rates for money.

On the New York Stock Exchange General Electric closed on November 27 at 131½ bid and 131¾ asked, a gain of 5½ points. Metropolitan Street Railway, of New York, closed at 194 bid and 194¼ asked, a loss of 1¼ points. Third Avenue Railroad, of New York, closed at 150½ bid and 153½ asked, a gain of 4½ points. Brooklyn Rapid Transit closed at 88 bid and 88¼ asked, a loss of 1¼ points.

On the Boston exchange American Bell Telephone closed at 355 bid and 358 asked, a loss of 7 points. Erie Telephone closed at 108¼ bid and 109 asked, a loss of 1¼ points.

FIG. 2.—CARBON MAKING. GRINDING AND MIXING PLASTIC MATERIAL.

On the Philadelphia exchange Electric Storage Battery closed at 120 bid and no asked price. Union Traction closed at 40¾ bid and 40⅞ asked, a gain of 1⅜ points. Electric Company of America, closed at 14⅛ bid and 14⅜ asked, a loss of 1⅛ points.

On the curb or outside market in New York Electric Vehicle closed at 75 bid and 80 asked, a gain of 5 points in the bid price. Electric Boat closed at 22 bid and 24 asked, a gain of 2 points. Electric Axle closed at 6¾ bid and 7¼ asked, a loss of ¾ of a point.

Wall Street, November 27.

Meeting of the American Institute of Electrical Engineers.

The 137th meeting of the American Institute of Electrical Engineers was held simultaneously in New York and Chicago, on Wednesday evening, November 22.

The paper on the programme was one by Mr. E. J. Willis on "A Test of a 300-Kilowatt Direct-Connected Railway Unit at Different Loads." The conclusion reached in the paper was that it is advisable to build direct-coupled street railway units with an under-sized engine using two eccentrics. The discussion on the paper was very short, being confined principally to a few questions asked by Mr. C. O. Mailloux. The feature of the programme was a topical discussion on wireless telegraphy. Professor Reginald Fessenden opened the discussion with a most interesting dissertation on recent experimental work in this direction. He exhibited to the Institute a very interesting wire model, showing the travel of a wave of electromagnetic induction across the conducting earth, and deduced Marconi's rule connecting the distance of transmissions with the square of the sending and receiving mass. He also exhibited a number of rough models of receiving instruments, mostly of the electrodynamometer class. The discussion was carried on further by Messrs. Mailloux, Kennelly, Pupin, W. J. Clarke, and others. Dr. A. E. Kennelly presided at the New York meeting.

The Telephone, Telegraph and Cable Company of America.

The completion of the board of directors of the Telephone, Telegraph and Cable Company of America, has not yet been announced, and rumor has it that there is a hitch in the personnel of the organization. Inquiry at the office of the company, at 100 Broadway, New York, by a representative of the ELECTRICAL REVIEW, developed the information that everything was running smoothly, but that the full board had not yet been selected.

The following appeared in the Philadelphia *Evening Bulletin*, of November 27, and, if true, will have a very important bearing on the affairs of the company:

"The colossal plan to control all of the independent telephone companies in the United States, and to combine therewith the great telegraph companies and the five Atlantic cable companies, for which purpose the Telephone, Telegraph and Cable Company of America was incorporated November 9, with a capital of $30,000,000, received a severe blow to-day, the effect of which may be far-reaching. This was none other than the withdrawal from the scheme of William C. Whitney, Thomas F. Ryan, Anthony N. Brady, William L. Elkins, P. A. B. Widener and Thomas Dolan, the men whose support made the success of the enterprise possible, and whose opposition or indifference may be fatal to its existence.

"The president of the company is William J. Latta, former general agent of the Pennsylvania Railroad Company in this city, which office he resigned September 1 last. Associated with him in the beginning of the enterprise were J. J. Astor, P. A. B. Widener, Charles R. Flint, Martin Maloney, F. M. Jenks, W. L. Elkins, Frank H. Tilford, W. H. Gelshenen, Thomas Dolan, Charles E. Adams, Oakes Ames and Charles Holbrook, of Boston; D. R. Francis, of St. Louis; William H. Crocker, of California, and James E. Hayes."

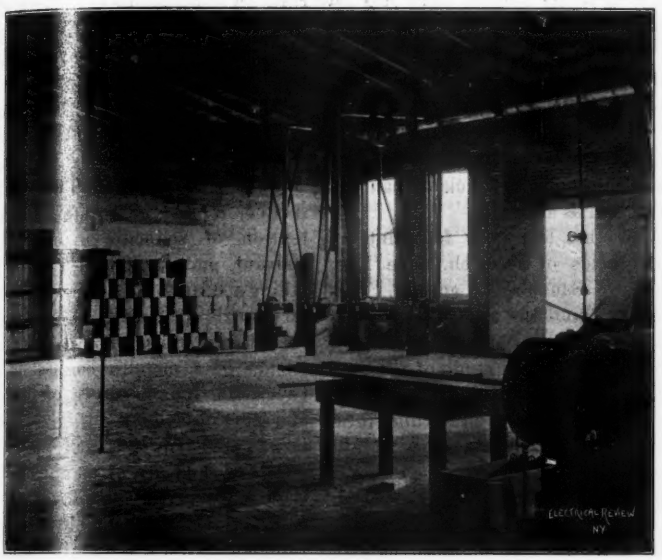


FIG. 3.—CARBON MAKING. FORCING OUT PLASTIC MATERIAL THROUGH SHAPING DIES.

A Gas Explosion.

In the middle of the afternoon of November 23, a gas main in the bottom of an excavation at the corner of Broadway and Canal street, New York city, was injured by a workman and, before all the men employed in the covered excavation could escape, a lighted lamp ignited the gas, causing a very violent explosion, which resulted in the death of one person and the injury of nine others. The effect of the explosion was to destroy a large amount of window glass in the neighborhood, and naturally to cause much commotion and panic on the crowded thoroughfares where it happened.

A Chance to Consolidate Telephone Companies.

TO THE EDITOR OF ELECTRICAL REVIEW:

In view of the fact that there is a movement on foot to consolidate all the independent telephone exchanges in the United States, it seems to me that there is a wide and remunerative field in the South for some man or men with energy to consolidate the exchanges of, say, Georgia and Florida, as there are a greater number of independent exchanges in these two states than in any other southern states. There is a "bonanza" for the man who succeeds in effecting a consolidation. Should any one wish further information and data, I will gladly furnish same upon request, with stamps for reply.

S. B. HUDSON.

Cuthbert, Ga., November 21.

Carbon Making.

Notwithstanding the enormous amount of carbon that is consumed for brushes and in arc lamps, very few know how this indispensable product, which has such marked physical properties, is manufactured. The illustrations accompanying this article show four processes in the manufacture of carbons in a well designed modern factory.

The raw material is Pennsylvania petroleum coke, which is made from the crude oil product of that state. This is delivered at the factory in lumps, and the first operation is its reduction in a crushing machine to about pea size. From the crusher the granular coke is elevated by a conveyer to bins, whence it flows into calcining retorts or furnaces, one of which is shown in Fig. 1. The crushed coke is maintained in these furnaces at an exceedingly high temperature, for a time long enough to thoroughly volatilize and destroy any hydrocarbon or volatile matter that might have remained in the coke. From these calcining furnaces the material is taken to a cooling room, where it is allowed thoroughly to cool before going through the next stage, which is grinding. Fig. 2 shows a set of grinding mills at work. These reduce the coke to the finest possible powder, which is then elevated to bolters where, by passing through bolting-cloth of various grades of fineness, all but the most impalpable powder is extracted and returned to the grinding room. The fine carbon dust is then stored in large bins awaiting subsequent processes of manufacture.

The mixture of this dust with the binding material is accomplished in mixing kettles, where the different ingredients are put together and thoroughly mixed and heated so that they come out in a plastic condition. This plastic mass is then pressed in hydraulic presses, the round rods intended for electric lighting, and rectangular rods to be sawed up into brush carbon, being pressed through a die, forcing out a rod of the material which, on account of the high pressure employed, is very uniform in texture as well as smooth and accurate in dimensions. Fig. 3 shows the pressing machine forcing out a strip of this material, which is being received on a tray and which will afterwards be cut up into short lengths for brushes. The trays are about five feet long, and this is the usual length of the rod of plastic material that is forced out at one operation.

After having been cut to the required lengths, the little bricks of semi-plastic material are then baked in furnaces, the tops of which are shown in Fig. 4, and subjected to an exceedingly high temperature for seven days. When the furnace is cooled and the carbons are taken out, they pass through various mechanical processes for the removal of the sand, etc., which adheres to them, grinding to insure accuracy of size and shape, and copper plating where this is necessary.

FIG. 4.—CARBON MAKING. TOPS OF FURNACES FOR FINAL HIGH-TEMPERATURE FIRING.

The illustrations shown represent scenes in the works of the Speer Carbon Company, St. Mary's, Pa., whose factory is representative of the best modern methods in this business. A unique advantage that is possessed by this establishment, is that natural gas is used as a fuel in the various kilns and furnaces, the result being that the temperature can be very closely regulated and maintained to the consequent benefit of the product.

Volta and the Voltaic Cell.*

(Concluded from page 345.)

Of Volta's stern adhesion to strict scientific method, and his condemnation of fanciful speculation, or merely sensational experiment, Professor Righi has much to say. "What possible good," Volta wrote, "can come out of all this, unless the observations are reduced to scale and measure, and especially in physical science? What is the use of ascertaining a cause unless the quantity and intensity of the effect is determined, as well as its character or quality." It was in obedience to this method that he was led to transform Nollet's thread electroscope, and Cavallo's pendulum electroscope, into measuring instruments, by the construction of the straw electroscope, which he took pains to calibrate by ascertaining the relation between the deflections and the corresponding tension, to use the word then in vogue.

The great success of his teaching at the University of Pavia is attested by Arago, who said that "the pride and pleasure of being able to call oneself a pupil of Volta contributed largely for more than 30 years to the great success of the University on the Ticino."

It was after his appointment to the professorship that Volta composed and published his memoir on the condenser. With this he was able to show the existence of electricity in circumstances in which the straw electrometer by itself was useless, such as, for instance, in his experiments on the electricity of contact. We may recall, too, the experiments made by Volta at Paris, in collaboration with Lavoisier and Laplace; and in London with Bennett, Magellan Cavallo and other members of the Royal Society, designed to show the production of electricity by the evaporation, the combustion and the expansion of gases, though modern opinion on the causes of this electrification differs from that which was expressed by Volta and others of his contemporaries.

Another good example of the application of the electrometer, combined with a condenser, is an experiment made by Volta on the nights of July 28 and 29, 1780, when the sky was illuminated by an exceptionally brilliant aurora; and this is an especially good instance, because it illustrates his extreme caution in drawing conclusions from observation. On these nights, by connecting a condenser and electrometer to an aerial wire, he obtained certain evidence of electrification and even small sparks. This appeared to prove the aurora to be certainly an electrical phenomenon. But later on he did not consider himself justified in considering the point rigorously proved, and writing nine years later to Dr. Bondioli, the author of a paper on the aurora, he declared himself certainly inclined to believe in the electrical nature of the phenomenon, and recognized the similarity between its appearance and that of the electric discharge in exhausted gases, but at the same time he uttered a warning in criticism of those who, he said, "are infatuated with electricity, and see electric fire in every spark and every flame in heaven and earth."

To the phenomena of natural electricity Volta gave many years of study, and published the result in his famous letters on meteorological electricity, addressed to Professor Lichtenberg, of Gottingen, and in a long memoir on hail, published by the National Italian Institution. These letters show most clearly, that while occupied with such arguments, he had constantly in his view the introduction of accurate measurement into his researches at every possible opportunity. With the desire of making the indications of different electrometers mutually comparable, and of founding a general system of graduation analogous to that used in thermometry, Volta proposed, in the first of the letters referred to above, to determine, by means of a balance, the equilibrium between known weights and the electrical force acting on a metallic disk suspended from one of the arms. But one step, though a very important one, was required to bring this arrangement to the modern guard ring electrometer of Lord Kelvin.

The action of flame in the discharge of an electrified body, similar to that of an innumerable number of sharp points, was discovered by Volta in 1787, and was of undoubted service in his study of the electrical phenomena of the atmosphere; and though its employment as a discharger is not usually convenient, yet recourse is still had to the flame, which presents some advantages in cases of rapid electrical variations or of imperfect insulation. This use of the flame is treated fully in the letters to Professor Lichtenberg, and some interesting experiments are described which might lead to other special applications of it. In one of these experiments, which is little known, having dissipated by the use of a flame the charge of a Leyden jar into the air of a room, he afterwards, by the same means, succeeded in collecting part of it into a new jar.

The theory of hail proposed by Volta, which attributes the freezing to the cold produced by rapid evaporation, is in its general lines still accepted, and the ingenious hypothesis of the electrical dance of the little hailstones between two oppositely electrified clouds, invented by Volta to explain their gradual formation and prolonged suspension, though now considered insufficient, can not be treated as absurd.

Volta has left deep footprints in other fields of research. De Lue, Roy, De Saussure, Lambert, Berthollet, Amontons and other accomplished physicists who were occupied with the important study of the dilatation of gases, had obtained discordant results. Volta's fine intuition divined that the cause of the discrepancy was the presence of water vapor, which was mixed with the air in many of the experiments. Having eliminated this, he obtained consistent results, which enabled him to formulate the laws of the proportionality between the increase of pressure of a given volume of air and the rise of temperature which produces it. He recognized, moreover, that air which contains a constant quantity of vapor behaves like dry air, and justly concluded that water vapor itself behaves like air. Finally, the postscript of a letter to Vassalli asserts that the quantity of vapor formed in a given limited space is the same, whatever may have been the space originally occupied, and however much air it may contain. Gay, Lussac and Dalton confirmed these results by numerous experiments, and were able to announce anew the laws which to-day bear their names.

So far the extracts from Professor Righi's address are taken from the part dealing with Volta's work which did not bear on the discovery of the pile. Those now following refer to Galvani's discovery.

Eight years older than Volta, Galvani's labors had already secured for him a wide and ungrudged reputation, though his habitual delay in publishing his observations led in some cases to the harvest of his honors by others. A survey of his existing MSS. shows that before 1780, he was occupied with the researches which led him to his famous experiment, and that before 1791, the year of publication of his masterly work, "De Viribus Electricitatis in Motu Musculari Commentarius," he had already prepared several accounts of his experiments, and had refrained from publishing them.

After it had been made evident that the lively muscular contraction of the frog, prepared in the classical manner which bears Galvani's name, constitutes an electroscope of immense sensibility, capable of detecting not only the feeblest charges of artifical electricity, but even of atmospheric electricity, Galvani occasionally observed the same contraction in special circumstances where the usual provocative cause was wanting. This singular fact could not fail to attract the attention of so acute an observer as Galvani, and, to put it shortly, by taking account of the condition necessary for its occurrence, he recognized that it was nothing more than the existence of a metallic connection between the lumbar nerve of the frog and the muscle of the thigh, in fact, it was sufficient to touch these two points of the body of an animal with the ends of a wire to provoke lively contractions, similar in all respects to those effected by the high tension of the electrostatic discharge.

Galvani's experiment, repeated everywhere with success as soon as it was made known, occasioned profound sensation. That Volta was among the first to occupy himself with it appears from a letter to Dr. Baronio of April 3, 1792. Not satisfied with verifying what he himself termed "the stupendous discovery of Galvani," he varied the conditions of the experiment in many ways, and applied himself to ascertaining the smallest discharge sufficient to cause the contraction, substituting for the simple wire a Leyden jar whose charges were measured by drawing them from another jar of known capacity. A few accurate and methodical experiments established the important fact that contraction was more lively if the lumbar nerve was connected to the positive armature and the muscle to the negative than in the reversed arrangement. Absorbed by interest in the new phenomenon, Volta for many years could not abandon its study, and, indeed, within a few months published a first memoir on animal electricity, followed soon after by another. Reading the limpid description of his innumerable ingenious experiments, one can follow step by step the laborious logic of his thought, and understand how, by slow steps, that mental evolution was accomplished which

*A lecture delivered in Como, Italy, September 18, 1899, by Professor Augusto Righi.

converted the admirer and supporter of Galvani's hypothesis into its opponent, and gave birth to the theory of contact.

His first experiments, in fact, seemed to corroborate Galvani's hypothesis, and his first memoir opens with a passage which does not less honor to the writer than to him of whom it was written. "The dissertation published by Dr. Galvani, of the Institute of Bologna, and professor in that university, who is celebrated for other discoveries in anatomy and physiology, on the action of electricity on muscular motion contains a great and luminous discovery which deserves to mark an epoch in the annals of physical and medical science, not only, nor so much, on account of its novelty, as for the fact that it opens a wide field for research, equally interesting and curious, and of the most valuable application. The third part of this work proves, by the evidence of many experiments, well combined and accurately described, that there exists a true and real animal electricity, that is to say, electricity excited by the living organs themselves."

It was in the course of these experiments on Galvani's discovery that Volta found the action of a circuit of two dissimilar metals to be greatly superior to that of a homogeneous circuit in its effect on the muscle.

Galvani's own experiments, described in the second memoir, showed that the muscular contraction was a secondary effect of the excitement of the nerve. Led by this to experiment on the nerves of sense, he discovered the curious effect of taste produced by the contact of two different metals applied to the tongue, an effect which, though unknown to him, had been described 25 years before by the Swiss philosopher, Sulzer, a member of the Academy of Berlin, in his "New Theory of Pleasures."

Gradually his suspicion assumed a more definite shape, and in letters addressed to Tiberio Cavallo, Volta declared himself to be persuaded that the phenomena observed by Galvani and himself were mainly due, not to animal electricity, but to a very weak artificial electricity produced in some way, not understood, by the contact of dissimilar armatures. At the same time, with admirable prudence, he added that certain effects, such as that of the contraction produced by a homogeneous wire, still appeared to be certainly due to animal electricity.

One point is worth special remark. He perceived at this stage that the electrical want of equilibrum was due, not to a momentary electrical flow like the discharge of a condenser, but to a continuous phenomenon, to designate which he began to use the term *current of electricity*. This conception naturally suggested new and varied experiments, which led him at last to exclude all animal electricity, and to formulate more and more clearly his own hypothesis.

What do you think, begins one of his letters to Vassalli, of the supposed animal electricity? I, myself, am continually more convinced that the whole action proceeds originally from the combat of two metals with one wet body, or with water itself, and that in virtue of this combat, the electrical fluid is thrust forward by the metals themselves into the wet body, or into the water, in some cases more, in others less actively (most actively of all in the case of zinc, least of all in the case of silver), and that by this an uninterrupted flow is induced through suitable conductors, and the fluid is drawn in a continuous circuit.

As may be supposed, the supporters of animal electricity descended into the field and accumulated experiments tending to establish their hypothesis. Among these Aldini and Dr. Eusebio Valli distinguished themselves by their bravery and activity. On his side Volta opposed new experiments and forcible arguments to those of his adversaries, and the famous battle, waged with ardor, but never without courtesy, spread beyond the borders of Italy and lasted many years. The spectacle was of extreme interest. Victory seemed to belong now to one side, now to the other, as a new fact or an ingenious argument changed the fortune of the combatants; but so great was the admiration excited by the valor of both, so evident was the love of truth by which all were animated that no partisanship or hope of victory for a particular side was anywhere evolved.

The first and most important objection to Volta's view was the experiment with the conductor composed of one metal, and his reply to this was that the homogenity was only apparent, and that small variations of temperature and other circumstances were sufficient to produce the effect.

Why have recourse, exclaimed Volta, to the supporters of animal electricity, to a principle, purely hypothetical, of a natural want of balance of the electric fluid in animal organs? This is merely a useless multiplication of the causes of the action by adding others of the same kind as the effects produced. Let us stand by that which has been directly and indisputably proved, and not be carried away by conjectures and hypotheses which may be elegant and attractive, but are hardly ever successful, and are useless if they do more than express the results of the most simple and clear experiments.

When once it had been established that an electro-motive force exists between two wet conductors of the second class (electrolytes) in contact it became impossible for the supporters of the hypothesis of Galvani to entirely exclude the intervention of contact electricity and the famous controversy began at length to languish.

The section of Professor Righi's address dealing with the invention of the pile begins thus:

Alessandro Volta's noble intellect shone nowhere so brightly as in his researches on contact electricity. A lively imagination, controlled at all times by the coolest judgment, a serene spirit in the face of difficulties, which compelled him to modify his ideas; a penetrating sagacity in contriving experiments, and unequalled skill in their execution; sane reasoning power in the interpretation and collation of facts, and in drawing conclusions from them—these were the salient characteristics of his lofty mind.

We all know how the new discovery (of the pile) astonished the world, what an outburst of admiration it produced, what well-merited honors it earned for Volta. And truly the impression produced can not have been otherwise than it was—prodigious. Since then we have been able, with extremely simple means, thanks to the pile, not only to produce many of the effects of the discharge of electrified bodies, but to obtain entirely new and unexpected results. Moreover, those previously known have a special character when produced by the pile, which renders them more useful or more interesting than before.

The researches which led Volta to the invention of the pile furnished him with the victorious weapon for a final combat with those who persisted in thinking the so-called galvanic fluid to be something different from the electric fluid, the supposed cause of electrical phenomena. In his first memoir on "The Identity of the Electric Fluid and the Galvanic Fluid," Volta most completly summed up the famous controversy and expounded his own theory. A distinguished nephew of the great Comascan has happily said that this is "a stupendous work, rich with new experiments and subtle arguments," and may be looked on as "his literary testament." The adventures of this memorial are curious and instructive. In 1805 a scientific society offered a prize for competition, inviting men of science to expound clearly, with dignity and without offence to any one, the question of galvanism at issue between our distinguished members Signor Giovanni Aldini and Signor Alessandro Volta. The prize was not awarded to any one of the three competitors, and the sealed envelopes which contained the author's names were burned. But one of these competitors was Alessandro Volta, and the work presented by him was this ponderous memoir. Nine years afterwards Configliacchi, Volta's successor in the chair of physics at Pavia, published the work in such a way as not to make it understood that he was not the author, and when long afterwards he composed a bombastic eulogy of Volta, he omitted this memoir from the list of his published works. Since then we have obtained evidence, now irrefragable, that the memoir really came from the pen of Volta.

In this victory (the discovery of the pile) luck had no part. It was the result of a long series of sagacious researches and ingenious experiments, inspired by consecutive logical deduction. Thanks to the pile, electricity has ceased to be merely an object of scientific interest, and has become a weapon of research, powerful, far reaching, catholic. By its aid, science has developed for mankind a multiform mode of energy which seems destined to produce a profound revolution in human affairs only comparable to that produced in remote ages by the use of fire.

Towards the end of 1792, soon after the discovery of Galvani, a distinguished Italian chemist, Giovanni Valentino Fabbroni, had attributed the muscular contraction of the frog to a chemical phenomenon. He had studied the effects produced when two different metals, immersed in a liquid, are placed in contact, and had recognized that these, which consist principally in the oxidation of a metal, do not occur unless the metals are in contact. According to Fabbroni, the moist body of the frog fills the place of the liquid in respect to the two metals of the conducting arc, and the contraction is due to the chemical action caused by

their contact. At the same time, Fabbroni showed that he was inclined to admit the production of electricity as a secondary effect. Afterwards Gautherot adopted this last supposition, and asserted that the chemical action was the true cause of the electrical phenomena which Volta had attributed to simple metallic contact. This idea, adopted by Wollaston, Nicholson and others, was generally elaborated and completed, and gave rise to the modern chemical theory of the Voltaic cell.

The chemical decomposition of electrolytes, which Nicholson, Carlisle, Vassalli and others effected by making the liquid form part of the circuit connecting the poles of the pile, soon showed that an intimate connection exists between the two kinds of phenomenon, and strengthened the chemical hypothesis. And although the theory of Grotthus and the laws of electricity formulated by Faraday and by our own countryman, Matteucci, have established that the electrolysis of the liquid and the passage of the current are inseparable phenomena, an explanation of the action of the pile can, nevertheless, be still based on Volta's contact theory.

And to-day, whether we attribute the starting of the action of electrolysis to chemical affinities existing between the several metals and the electrolyte, or to the electrification of metals by their mutual contact, and whether, in consequence, we formulate a theory of the pile on the chemical or on the contact hypothesis, it will not be possible to establish the truth of the former, as against the latter theory, except by a direct proof, that no electricity is produced by simple contact between heterogeneous substances.

Generally speaking, a new theory which penetrates the surface of the hidden causes of phenomena may thrust a little farther back the limit between the known and the unknown, but can not give us a view of the first cause. At present it seems possible to base an explanation of the phenomena of the pile on the conception of floating atoms or groups of atoms, integral parts of the molecule, whose electrical charges they bear, and it may seem possible to extend the principle of this explanation to other electrical phenomena. But supposing we succeed in doing all this, shall we have explained everything? Certainly not. We come then face to face with the question: In what does the electrical charge of an ion consist?

Indeed, we have as yet no precise idea of what the electrical charge of a body or atom may be. The intimate nature of that electricity whose masters we are, which we use in a thousand ways, from which this dying century may draw its characteristic designation, is still a mysterious sphinx defying us from afar. But it is not possible to feel discouragement while we are speaking of Volta. The great progress made in electrical science in our age gives us confidence in future victories, perhaps far greater than those already won. That this progress is mainly due to the pile is the chief glory of Volta. But with this honor he possesses another, that of having restored to our system of research the rigorous experimental method which had been taught by Galileo, from which we had wandered. By keeping our attention on the example of these great leaders, as beacons lit to guide our way, we shall certainly succeed in making the longed for progress, and shall continually approach an intimate knowledge of the nature of electrical phenomena.

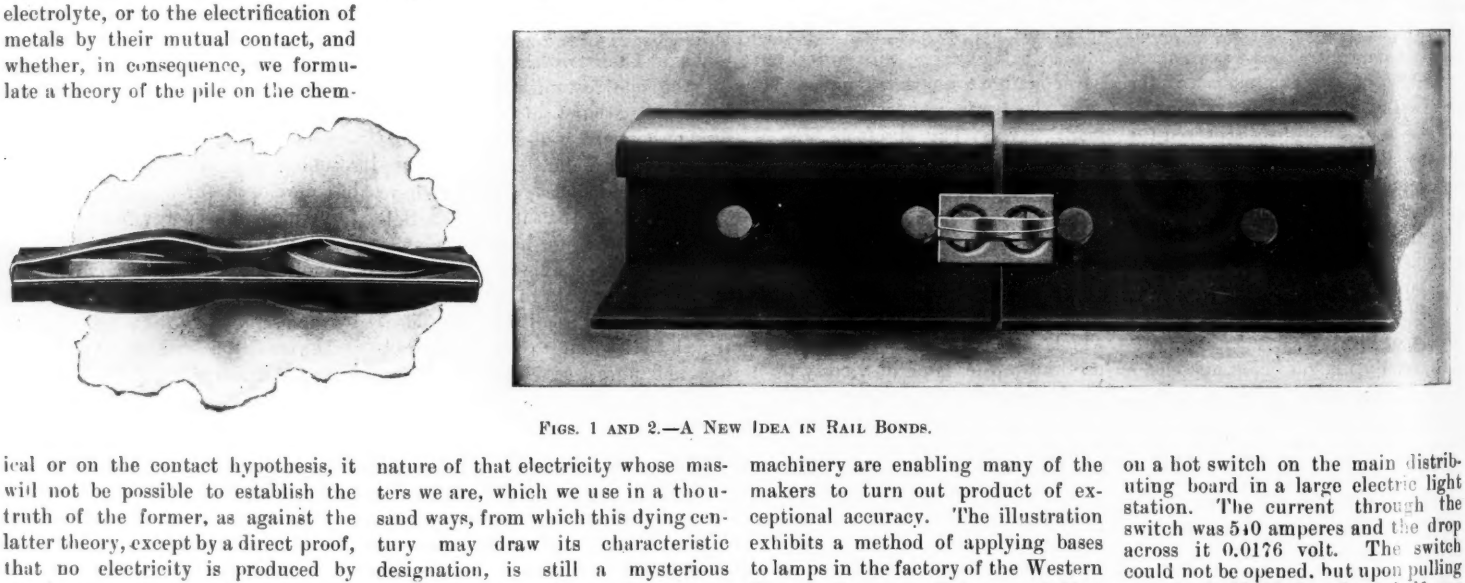
METHOD OF BASING INCANDESCENT LAMPS.

Incandescent Lamp Manufacture.

The manufacture of incandescent lamps, which was in its early days almost an experimental work, has been standardized to a very great extent, and new processes and improved machinery are enabling many of the makers to turn out product of exceptional accuracy. The illustration exhibits a method of applying bases to lamps in the factory of the Western Electric Company, Chicago and New York, who are makers of the "Sunbeam" lamp. It is well known that the bases are attached to the glass part of the lamp by a plaster of Paris cement, and that when this is done by hand the base is sometimes crooked, spoiling the appearance and often the usefulness of the lamp. The mechanical arrangement shown results in a uniform product.

A New Idea in Rail Bonds.

The type of rail bond shown in the accompanying illustrations, is one that has been designed to meet conditions requiring a combination of good conductivity with ease of application and low cost. Fig. 1 shows the bond as it appears before being placed in position on the rail. It consists of a rectangular slab of rolled copper, its thickness depending upon the amount of conductivity desired, in which are cup-shaped depressions at each end. In these are placed steel springs, similar to those used for locking the nuts of a fish-plate, and these latter are temporarily held in place by a strap of sheet-iron, which is cut in two by the sharp edges of the springs after the fish-plate has been forced down over the bond. Fig. 2 shows a rail joint with this bond in position ready for the angle-plate. The whole surface of the copper bond is amalgamated to prevent its rusting, and the contact surfaces are covered with a plastic amalgam which insures practical metallic contact between a large area of the bond and of the rail. The rail is polished and cleaned before the application of the bond by means of an emery wheel, driven by hand, and is also lightly amalgamated by the use of a special compound made for the purpose. Mr. Harold P. Brown, of New York, the manufacturer of these bonds, has made some interesting experiments upon the properties of the plastic alloy, in connection with which he has been well-known for some time. A very important test was that made on a hot switch on the main distributing board in a large electric light station. The current through the switch was 510 amperes and the drop across it 0.0176 volt. The switch could not be opened, but upon pulling out the knife-blades about half way and treating the surface with the plastic amalgam, then thrusting them back into the jaw, the drop under the same current became 0.00168 volt, or less than one-tenth of its original value. Those who attended the late convention of the American Street Railway Association, in Chicago, will remember the interesting experiments made there upon conductivity and resistance of joints by Mr. Brown.



FIGS. 1 AND 2.—A NEW IDEA IN RAIL BONDS.

THE MANHATTAN SYSTEM—WHAT ELECTRICITY WILL ACCOMPLISH—UNJUST CRITICISM.

BY BURTON ELLINWOOD GREENE.

For several weeks the financial pages of the daily papers have been filled with advertisements predicting all sorts of dire things for the Manhattan Elevated Railway Company. "Truthseeker," whose signature has come to be almost as well-known as the familiar "Old Subscriber" of the country weekly, has expressed his opinion that the stock will sell at 30 or less. Tips to sell the stock short have been circulated from Dan to Beersheba, from Candahar to Cuttyhunk.

The entire structure has been represented as being in danger of collapse at any moment. Colonel Murphy and his corps of inspectors have spent sleepless nights in the effort to suggest to the company ways and means to avert the impending doom, and have found two supporting pillars out of plumb. Of course it is understood that the company itself has no interest in preventing an accident, which might cost it a million dollars. Teamsters have been advised to avoid driving under the structure, lest they be caught in the general smash.

It is time, I think, for the dissemination of a little knowledge as to what may reasonably be expected of this property in the future. If it is worthless the sooner the small stockholders unload the better for them. If, on the other hand, it is one of the safest and most stable investments offered in Wall street, then it is time to make that fact known. And the latter proposition is susceptible of absolute proof.

Before passing to the question of what Manhattan can earn with its new electrical equipment, I wish to refer to the criticisms by the public at large and almost all the newspapers, that the company unnecessarily delayed the change of motive power.

These criticisms are absolutely without foundation.

Up to almost the present time the state of the electrical art has never justified the expenditure of the vast sum necessary for the change. No system had been sufficiently developed to offer any guarantee that the money would be well spent—that the entire equipment would not be soon relegated to the scrap-heap, and something else substituted at a further large expense.

As late as three years ago Mr. George Westinghouse, Jr., head of the large company which bears his name, advised the Manhattan officials not to hurry, and it was generally understood at that time that neither the Westinghouse nor General Electric companies, the only ones in the world fit to undertake the job, could offer anything on which they were willing to risk their reputations.

The Manhattan directors have used exquisite judgment in postponing the change till the present time. Now the system which they have adopted has been thoroughly tested in actual practice. The bugs have been discovered and corrected. It is standardized. Both the manufacturing companies above mentioned are now ready to stand for what they deliver. Every engineer of prominence in the country concurs in this view. I might mention the names of a score with whom I have lately discussed the question, and there was only one opinion.

The costliness of the error of rushing into the electric railway business before the state of the art justified it, has been thoroughly demonstrated by the long list of expensive experiments in this direction.

Mr. Henry M. Whitney, of Boston, and Mr. Thomas Lowrey, of Minneapolis could give illuminating discourses on this subject. The equipment of the West End system has been changed at least four times, and of the Twin City system not less than three times. The latter was nearly bankrupted by the expense, and Mr. Lowrey has had to wait eight years to see his system win itself out and its reestablishment as a good profit earner.

The first car equipments used on both these systems cost about $4,000 a car. To-day the price for infinitely better apparatus is about $800 a car.

These two roads are only cited as examples. The list could be extended indefinitely. While men of the type of Mr. Whitney and Mr. Lowrey may be considered public benefactors for their pioneer work, stockholders of most corporations prefer to stand aside and let somebody else do the experimenting.

Here I would like to pay a well-merited tribute to Mr. C. A. Coffin for his part in developing electrical railway work. It is due to his enthusiasm and energy, more than to any other single cause, that America is nearly ten years in advance of England in this business, and that we are selling foreigners all the apparatus for their best systems.

It is not true, as has been claimed, that the original appropriation of $18,000,000 is inadequate for the work of the Manhattan equipment, owing to the advance in price of supplies. The money is ample. The cost of some things has advanced since the directors voted in favor of the change. Copper, however, one of the important items, is cheaper. The appropriation is not only large enough to cover all purchases, but to provide for an overhauling of the structure from end to end, including the stations.

Now what can be expected of this system when the change of motive power is completed?

Of course it is true that there is no exact parallel to make comparison with. There are no other large elevated railway systems in the country. Every comparison made with large trolley roads, however, would be less than fair to Manhattan. The increase in traffic, the reduction in operating expenses, are absolutely sure to be more striking than on any trolley road (either overhead or underground) in the country.

In Philadelphia the Union Traction Company has increased its gross receipts from $8,100,000 in 1894, to $11,100,000 in 1898, and reduced operating expenses from $5,446,604 in 1894, to $4,608,163 in 1898.

In Pittsburgh the Consolidated Traction Company for the same period has increased gross receipts from $1,500,000 to $2,000,000, and reduced operating expenses from 60 per cent to 44 per cent.

In this city the Metropolitan system's gross receipts have grown from $8,745,495 in 1894, to $11,363,227 in 1898, and operating expenses reduced from 60 per cent to 50 per cent.

These are as fair comparisons as could be cited; but none of them does Manhattan justice.

In the first place the percentage of operating expenses to gross receipts will be lower than is possible on any surface road where stops are made on every block, as against one stop in five or six blocks on the elevated road.

Secondly, the increased comfort of travel can not but result in an immediate increase in passengers carried and in gross revenue.

Under the new arrangement *the capacity of the system will be increased about 40 per cent.* This will be in part accomplished by the substitution of a passenger car (motor) in place of locomotive and tender, and in part by the increased speed obtainable.

In the Summer time full trains of open cars will be run, and a journey on the elevated will be changed from a necessity to a genuine pleasure.

During the hours of light travel, instead of a five-car train once in five or ten minutes, trains of one or two cars will be run on *one minute headway.* For the public at large this is probably the most important feature offered by the change from steam to electricity.

The Union Traction road in Philadelphia is operated on 40 per cent of gross income. The Manhattan system should do even better than this. The operating expenses for the year just closed were a trifle over 56 per cent.

The increase in revenue, as indicated by comparisons mentioned above, should be not less than 30 per cent, showing a total of about $12,000,000.

Deducting fixed charges of $2,717,289 (as per current report), there would be left for the stockholders $4,882,711, or 10 per cent on the entire issue. This is a conservative rather than an optimistic estimate.

The position of the Manhattan Railway Company is impregnable. It is not a shadow. If any of the many consolidations talked of are ever carried out, the Manhattan company holds the key to the situation every time. This is especially true as regards a closer union with Brooklyn.

And it would be strange indeed if the capitalists of the company are not found in the syndicate which will build the tunnel road.

Stockholders in the company need have no anxiety. The system will be again as it was in its early years, one of the wonders of the metropolis, and *electricity* will score one more in an almost endless list of commercial and scientific triumphs.

ADVANCE INFORMATION

Electric Light and Power.

ILION, N. Y.—The Herkimer County Light and Power Company, which operates in Ilion, Herkimer and Mohawk, has decided to put in a system of incandescent lighting in Ilion. Operations will commence at once, and the work pushed to completion as soon as possible.

BUTTE, MONT.—The Butte Gas Light and Fuel Company has been incorporated; A. J. Davis, W. L. Moyer, A. H. Barrett, R. W. Place, of Butte, and J. P. O'Dell, of Chicago, incorporators.

ALBANY, N. Y.—The Norwich Gas and Electric Company has been incorporated with a capital stock of $100,000. The directors are Edward L. Smith, E. Floyd Kiser, Charles P. Nelles, N. N. Betts, of Tonawanda, Pa.; James H. Throop, Norwich; Robert E. Drake, Syracuse; Selwyn N. Blake, Elmira.

PAINT ROCK, TEX.—J. F. Ford & Son contemplate putting in an electric light plant. They will operate with water-power.

BRILLION, WIS.—An electric light plant is to be established here. A 15-year franchise has been granted to C. Behnke & Son, of this village.

NEWMARKET, N. H.—The Newmarket Electric Light, Heat and Power Company has been incorporated; capital, $1,000; incorporators, J Pinkham, C. E. Tasker, A. C. Haines, C. A. Morse, C. W. Rogers, all of Newmarket; A. W. Griffiths, J. W. Burnham, both of Durham.

CANANDAIGUA, N. Y.—M. D. Munger is circulating a petition asking the trustees to grant him a franchise for establishing a mercantile electric lighting system in this village.

RIDGE FARM, ILL.—The Ridge Farm Electric Light, Heat and Power Company has been incorporated; capital, $5,000; generating electricity for light, heat and power purposes. Incorporators, William Bedinger, Everett A. Little, Charles T. Lourig.

BLISSFIELD, MICH.—The Blissfield Electric Power Company has been incorporated; capital, $10,000; incorporators, W. Schroder, Caroline P. Schroder, C. F. Seeger, J. E. Forsyth, J. Baily, all of Blissfield.

WATERBURY, CT.—The board of control, which consists of Gov. G. E. Lounsbury, Comptroller Grant and Treasurer Mersick, have under consideration the matter of establishing an electric light plant in the capitol, for the purpose of lighting the building and grounds with electricity.

New Electric Railways.

FRANKFORD, DEL.—A proposition to build a trolley line between this place and Ocean View is being discussed.

WARSAW, IND.—The contract has been signed by eastern capitalists for the building of an electric road between Logansport and Kendallville. It will pass through the richest part of the country, giving the people remote from railroads the advantages of quick transit.

MCKEESPORT, PA.—The United Traction Company has decided to extend its line now running to Glassport as far as Elizabeth, and work will be commenced in a few days.

BURLINGTON, VT.—The Burlington & Hinesburg Railroad Company will build an electric railroad from this city to Shelburne.

CLEVELAND, OHIO—The Little Consolidated Railway Company, of which Senator Hanna is president, has decided to change the motive power on the Superior street and Payne avenue cable lines to the overhead trolley.

JEFFERSON, TEX.—The Jefferson & Northwestern Railway Company has been incorporated; capital stock, $20,000. Purpose to construct and maintain line of railway from Jefferson through the counties of Marion and Cass in a northwesterly direction, 20 miles to a point on the Moses D. Frazer survey, four miles southwest of the town of Linden, in Cass County. Incorporators, E. Bancker, of Jackson, Mich.; M. S. Clark, of Dallas; J. R. Darnell, of Jefferson, and others.

ATHOL, MASS.—There is a prospect of an electric road from Athol to Templeton, a distance of nine miles. P. S. Hirsh, of New York city, one of the promoters of the Gardner & Templeton road, which is nearly completed, is interested in the matter.

New Incorporations.

CINCINNATI, OHIO—The Fitzsimmons Telephone Manufacturing Company has been incorporated to manufacture telephones; capital, $5,000; incorporators, P. Fitzsimmons, W. C. Weidling, D. J. Hauss, C. F. Deise, Ida Heitz, all of Cincinnati.

JERSEY CITY, N. J.—The Forto Electric Company, principal office, No. 76 Montgomery street, has been incorporated to manufacture goods, wares and merchandise; capital, $100,000. Incorporators, Maurice Maas, Henry R. Blauvelt, Elisha S. Coldwell, all of New York city.

JERSEY CITY, N. J.—The Strong & Totten, principal office No. 493 Central avenue, has been incorporated; capital, $10,000; incorporators, Robert B. Strong, Plainfield, N. J.; Arthur B. Totten, Middlebush, N. J.; James Agnew, Jersey City.

DENVER, COLO.—The Gold Belt Consolidated Electric Company has been incorporated; capital, $300,000; Syl T. Smitk, George E. Ross-Lewin, C. F. Lacombe, M. L. Stern, Thomas Keely; Denver and El Paso, Fremont and Teller counties.

SAN FRANCISCO, CAL.—The Merced Falls Gas and Electric Company has been incorporated; capital, $250,000; incorporators, G. Crocker, C. E. Green, A. F. Morrison, C. H. Shaw, all of San Francisco; J. D. Bradley, of Merced.

New Telephone and Telegraph Companies.

SIOUX FALLS, S. D.—The American District Telegraph Company has been incorporated with a capital of $100,000; incorporators, J. M. O'Neill, I. McMichael and J. Levin.

WILMINGTON, DEL.—The Central Telephone and Telegraph Company has been incorporated; capital, $125,000; incorporators, W. D. Bannard, of Philadelphia; W. C. Mayne, of Bristol, Pa.; G. W. Kimball, of Wilmington.

WATERVILLE, ME.—The Gray Telephone Company has been incorporated; capital, $300,000; incorporators, H. W. Whitney, of Brookline; E. Gray, J. B. Millet, A. J. Mundy, all of Boston; H. M. Soule, of Newtonville, Mass.; C. W. Davis, of Waterville, Me.

GALION, OHIO—An independent telephone company has been organized at this place.

JACKSON, MICH.—A stock company is being organized at this place, for the purpose of building a telephone line from that city to Mason, to connect with the Leslie exchange and the new state telephone line at Jackson and Mason.

KAMLOOPS, B. C.—The new Dominion government telegraph line from Kamloops to Lower Nicola has just been completed, and it is expected that the first message will be sent over the wire early next week. The line is 70 miles in length.

Increase of Capital.

YORK, PA.—The Tucker Manufacturing Company has increased its capital from $5,000 to $25,000.

ELECTRIC RAILWAY NOTES.

The nine street railway companies operating in and around Allentown, Pa., were recently merged into the Lehigh Valley Traction Company. The capital stock of the company is $3,000,000 and the bonded debt $3,000,000.

The McKeesport (Pa.) & Youghiogheny Street Railway Co. has given a mortgage of $100,000 to the Pittsburgh Trust Co. C. B. McKay, president of the Pittsburgh Trust Co., says it is a trustee's mortgage, given for an issue of bonds.

The street railway mail cars on the cable lines of Chicago are to be replaced in the near future by handsome cars on the electric lines, and the change is expected to make a great improvement in the transportation between the main office and the stations. Postmaster Gordon has been planning the improvement for some time past, and after a conference with officials of the North Chicago Street Railway Company, it was arranged to make the first change of this kind on the north side.

Health Commissioner Ohage, of Minneapolis, Minn., has received a communication from the medical fraternity of the city requesting him to take such action as may be deemed practicable to secure more convenient means of getting on and off some of the street cars. He is informed, in the letter, that the Ramsey County Medical Society considered the subject carefully at its last meeting, and decided that something should be done. A committee was named to act in the matter. The complaint is for the most part about high steps on cars.

A syndicate has been organized in Canada for the purpose of building an electric road in Demerara, British Guiana. The projected line will be an overhead trolley. It will be 10 miles in length. Sir W. C. Van Horne, president of the Canadian Pacific Railway, and B. F. Pearson, capitalist, of Halifax, hold a prominent interest in the scheme. It is stated that parties closely affiliated with the Metropolitan Street Railway, of New York, have also furnished funds for the venture. All the material and equipment necessary for the completing of the road will be purchased in the United States.

An American-Canadian syndicate was recently formed with the object of operating 100 miles of trolley line in Sao Paulo, Brazil. A large hydraulic plant is now being erected some 20 miles out of that city. F. S. Pearson, consulting engineer of the Metropolitan Street Railway, who acts in a similar capacity, and is one of the leading lights in the Sao Paulo Company, has just returned from Brazil, where he has been superintending the construction of the trolley and hydraulic plant. Mr. Pearson has now under consideration the awarding of a $700,000 contract for electrical equipment. More than 1,000 tons of seven-inch girder rails will next week be shipped to the Sao Paulo Company for the construction of the road. The rails are being supplied by the Pennsylvania Steel Company.

Kindred.... ...Interests

The Electric Appliance Company, Chicago, have issued a Thanksgiving proclamation to electricians to be thankful for Eaco tape.

Second-hand machines of many standard sizes and types are offered by the Lincoln Electric Company, 71-73 Ontario street, Cleveland, Ohio.

The Chicago Insulated Wire Company, of Chicago, report increased sales of wires, and state that their factory is running to its fullest capacity to take care of orders.

The Electric Appliance Company, Chicago, are sending out samples of their new "Eaco" tape. This tape is composed of one third rubber, and its manufacturers believe it has the qualities the trade is looking for in a good tape.

The New Catalogue of the Illinois Electric Company, of Chicago, has been sent to a large number of electrical firms throughout the country, and contains a complete list of supplies for all branches of the trade. This company is doing an excellent business.

The International Correspondence Schools, of Scranton, Pa., have established a monthly publication called *The Official Messenger of the International Correspondence Schools.* It is issued for free distribution among the employés of the schools, and contains interesting facts and figures regarding their development. The publication is handsomely printed and is edited by Mr. George F. Lord.

The Western Electric Company is installing three 70-horse-power motors in Schlesinger & Mayer's building, Chicago. These motors are especially designed to drive the pumps for the elevators, and are to work against a constant pressure of water at all speeds. The speed variation which is from 175 to 350 revolutions per minute, is governed by an automatic controller which cuts in or out various sections of series field winding.

Messrs. Schiff, Jordan & Company, 232-4 Greenwich street, New York, report an unusually heavy demand for their high-grade imported "ship" Nuernberg carbons. They particularly wish the electric lighting stations throughout this country to know that they are carrying an extra large stock of assorted carbons for open and enclosed lamps, also alternating and direct-current lamps, and are in a position to make prompt shipments. They have recently issued a new price-list which they will be glad to send upon application.

The Berlin Iron Bridge Company, of East Berlin, Ct., has just shipped a train-load, comprising twenty-seven cars, of structural material, consigned to the United States Commission at Paris, France. The material is for the steel framework of a machine shop, to be used exclusively by the American exhibitors of iron and woodworking machinery at the Paris Exposition in 1900. The building will be 343 feet long and 77 feet wide. It will be constructed of American products shipped on a government transport and erected by American mechanics, who will go to Paris for that purpose. The building itself, in all its details, will constitute an American exhibit.

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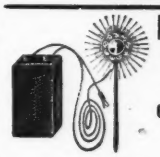

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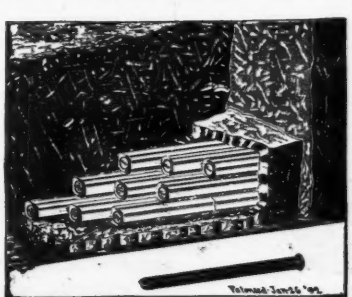

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Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED NOVEMBER 7, 1899.

636,685 Weight and pressure recording apparatus; E. McGarvey, Bellefont, Pa.

636,694 Fish decoy; E. F. Pflueger, Akron, Ohio.

636,695 Burglar alarm; H. J. Pyle, Pueblo, Colo.

636,707 Weft-supply mechanism for looms; W. H. Baker, Central Falls, R. I.

636,721 Advertising apparatus; W. H. Gilman, Boston, Mass.

REISSUE.

11,783 Electric motor; T. Duncan, Chicago, Ill.

11,786 Electromagnetic brake; F. C. Newell, Chicago, Ill.

ISSUED NOVEMBER 14, 1899.

636,748 Rock or coal drill; H. H. Bliss, Washington, D. C.—A driven shaft, an electromotor for imparting rotary motion thereto, having an armature mounted independently of said shaft and a supplemental electromotor for moving the shaft longitudinally, it having a series of two or more electromagnets adapted to be successively brought into action.

636,773 Loom; W. C. Edler, Philadelphia, Pa.

636,776 Means for generating electricity from car-wheel axles; P. Eggleston, Newark, N. J.

636,779 Electrical bell-ringer for street cars; F. A. Enz, Pittsburgh, Pa.

636,804 Quick-break electric switch; G. L. Holton, Utica, N. Y.

636,871 Ceiling fan motor; H. H. Wait Chicago, Ill.—A magnet frame and brackets mounted on the frame, journals formed in said brackets, an armature within the frame having a tubular shaft journaled in said bearings, and a fixture-support projecting freely through said shaft and carried in the upper bracket.

636,872 Telephone trunk-line signaling; T. C. Wales, Jr., Newton, Mass.

636,875 Electric arc lamp; E. P. Warner, Chicago, Ill.

636,881 Electric band; J. M. Wolksky, Irwin, Pa.

636,897 Electric generator or motor; C. H. Cutting, Derby, England—A yoke provided with a transverse opening and a field-magnet which is connected with said yoke and projects through said opening.

636,905 Distributing panel for electric circuits; C. J. Klein, New York, N. Y.—Consists of a switchboard or panel board, slotted contact-pieces mounted thereon for receiving a removable fuse-holder and springy pieces flanking the upright slotted contact-pieces and arranged opposite the slots thereof.

636,910 Electric alarm system; R. R. May, San Jose, Cal.—A source of electricity and an alarm, an electromagnetic circuit closer comprising an electromagnet having an armature movable under the influences thereof and adapted to close the circuit through said alarm, terminals adapted for engagement by the movement of said armature, and a tumbler in the path of the armature adapted for movement thereby to hold the armature in a position to engage the terminals.

636,937 Electric railway; W. H. Wright, Buffalo, N. Y.

636,938 Manufacture of electric batteries; E. Baines, New York, N. Y.—In the manufacture of an electric battery the method of compounding lead oxid, sulfuric acid and finely-divided charcoal to wit: first mixing lead oxid and sulphuric acid to form a binder and second incorporating finely-divided charcoal with this binder.

636,956 Process of making battery cups; F. G. Curtis, Everett, Mass.

636,964, 636,965 Electric vehicle; T. B. Entz, Philadelphia, Pa.

636,980 Truck for electric cars; J. Goetti, Boston, Mass.

636,989 Quick-break electric switch; R. R. Hewson, San Francisco, Cal.

636,989 Quick-break electric switch; R. B. Hewlett, San Francisco, Cal.—Consists of inner and outer tubes, one slidable within the other, one of said tubes having a portion of its length of low electrical resistance and the remaining portion of high electrical resistance.

637,006 System of electric traction; L. M. Maxham, Boston, Mass.

637,012 Electric burglar-alarm; Geo. McGan, St. Louis, Mo.

637,057 Electric igniter; C. D. Wright, Chicago, Ill.

637,058 Electric lighting attachment for gas-fixtures; C. D. Wright.

637,059 Combined type-writer and telegraphic transmitter; C. E. Yetman, Oak Park, Ill.—Consists of a rotating driver and the series of circuit-rings mounted thereon, of the corresponding reciprocating shifters, having rounded insulation seats to engage the respective rings, and supplemental insulation-wings to space adjacent circuit-rings apart.

637,060 Electric arc lamp; T. E. Adams, Cleveland, Ohio—Consists of a carbob-rod, a ring clutch and a lifter, of a weight applied to said ring-clutch independently of the lifter and at the same side of the clutch as the attachment thereto of the lifter.

637,071 Electric battery compound; H. Blumenberg, Jr., New York, N. Y.—Composed of a bisulfate of sodium, and an active oxidizing agent in a dry condition.

637,073 Electric battery; H. Blumenberg, Jr., New York, N. Y.—The carbon electrode in the form of a cup having through the rim at one place a hole for the free passage of the conductor and its insulating-covering, a channel in the bottom of the carbon electrode and a connection between the end of the conductor and the bottom of the carbon electrode.

637,115 Residence electric plant; G. M Hise, Assumption, Arcola, Ill.

637,119 Electric railway; R. M. Hunter, Philadelphia, Pa.

637,120 Manufacture of electrical fuses; R. M. Hunter, Philadelphia, Pa.—Consists of a mold, a pressure device for introducing into the mold a fusible alloy under a predetermined pressure and an automatic pressure-regulating device constructed and arranged to be actuated by said pressure device.

637,179 Secondary electric clock; J. J. Stockall, Sr., London, England.

637,195 Loom; W. H. Baker, Central Falls, R. I.

REISSUE.

11,787 Electric motor; C. R. Meston, St. Louis, Mo.—Consists of a suspending tube, a plate secured to said tube, a frame plate secured to a plate, but insulated therefrom, a field-magnet core supported by frame, a fixed shaft depending from the same frame, an armature mounted on said fixed shaft, and a fan-blade secured to said armature.

ISSUED NOVEMBER 21, 1899.

637,232 Automatic fire-extinguisher; J. Butcher, Jersey City, N. J.

637,246 Snap-switch; M. Guett, Hartford, Ct.—A base, a hinged contact carrier, a hinged operating part, a spring engaging said contact carrier and said operating part, a lateral projection on the contact carrier, and a lateral projection on the operating part to alternately engage opposite ends of the projection upon the said contact carrier.

637,261 Multiphone; J. A. Irving, Philadelphia, Pa.

637,290 Telegraph key; C. J. Schaeffer, New Castle, Pa.

637,410 Process of and apparatus for disassociation of substances by electrolysis; G. H. Pond, Ashburnham, Mass.

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